Marbek

APPLIANCE EFFICIENCY
INFORMATION BASE

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1. INTRODUCTION

1.1 Background

This document constitutes a Final Report for the project entitled:

Appliance Efficiency Information Base

This project has been undertaken jointly for the Ontario Ministry of Energy and Energy, Mines and Resources Canada under contract 6832/-680097 from the Ontario Ministry of Energy.

Both the Federal and Ontario governments are investigating the desirability and benefits of further appliance efficiency programs in the context of the achievements made to date in Canada and the implications of the new U.S. appliance efficiency legislation. The develoment of an appliance efficiency information base was felt to be essential to this effort.

1.2 Purpose and Objectives

The basic purpose of this project is to consolidate, assess and provide information to the Ontario Ministry of Energy and Energy, Mines and Resources Canada on the basis of which both agencies can develop policies and programs regarding the energy efficiency of major household appliances and heating/cooling equipment--especially in light of recent U.S. appliance efficiency legislation and advances being made by offshore manufacturers.

The detailed objectives of the project are:

a) To conduct a technical literature survey and compile data to assess the relative energy efficiency of U.S. and Ontario/Canadian manufactured appliances currently on the market;

b) To assess the new U.S. appliance legislation in terms of the expected impact on appliance efficiency levels for U.S. markets and the likley timing of their introduction;

c) To provide a comparative assessment of existing and potential energy performance improvement for Canadian manufactured appliances relative to products manufactured in the U.S. and selected offshore manufacturers;

d) To consolidate information and statistics on the Ontario/Canadian appliance manufacturing industry and markets that will assist in identifying energy and industry impacts of appliance efficiency programs;

e) To assess the potential impact of introduction of U.S. appliance standards on the Ontario/Canadian manufacturers; and,

f) To provide a workshop for discussion with key U.S. figures involved in the design and development of U.S. appliance standards research and legislation.

The workshop referred to in objective f) was held on March 24, 1987 in Toronto. Much of the initial work on this project was presented at that workshop and has subsequently been included in this report.

As also requested, The Ministry of Energy's Appliance Stock Replacement Model was reviewed and calibrated with new data. This work was provided as a separate deliverable.

1.3 Scope

The scope of this project in terms of the products covered includes the following:

- kitchen/laundry appliances:
  - refrigerators
  - freezers
  - ranges
  - dishwashers
  - clothes washers
  - clothes dryers

- heating/cooling equipment:
  - furnaces (oil, gas, electric)
  - air conditioners (room and central)
  - heat pumps
  - domestic water heaters
  - pool heaters
  - room heaters

1.4 Limitations

While the project covers both kitchen/laundry appliances and heating/cooling equipment, the recognized priority is on the kitchen/laundry appliances. Accordingly, the majority of research in this project has focussed on these products where data is most available. In particular, the lack of heating/cooling product efficiency ratings in Canada has made direct comparison with U.S. products impossible.

Further work under another auspices will be necessary to more fully analyse the heating/cooling equipment industry. Until such time as comprehensive efficiency testing is undertaken in Canada, it will not be possible to accurately assess the efficiency of this industry's products on the Canadian market.

2.0 INDUSTRY PROFILES

2.1 Current Appliance Production and Sales

Activity in the 1986 Canadian appliance market is summarized in Table 2.1: Canadian Appliance Production, Sales and Exports which provides statistics on the number of units produced in Canada, the Canadian sales (domestic, imported and total) and the exports from Canada for each of the six major kitchen and laundry appliances plus microwave ovens.

From this table, several points with regard to imports and exports are worth noting:

- imports acccount for:
  - 18% of refrigerators sold
  - 17% of automatic clothes washers sold
  - 12% of dishwashers sold (which is down from 47% in 1979)
  - 10% of clothes dryers (electrical) sold
  - 85% of microwave ovens sold
- exports account for:
  - 30% of Canadian freezer production (estimate)
  - 12% of clothes dryer production.

Similar statistics are available for the last several years if historical trends are of interest.

In terms of the Ontario market, Table 2.2: Canada/Ontario Appliance Comparison provides the proportion of national sales in Ontario and a comparison of National and Ontario saturation rates.

TABLE 2.1

CANADIAN APPLIANCE PRODUCTION, SALES AND EXPORTS 1986 (000's of UNITS)

	PRODUCTION(1)	**SALES**(2)				**EXPORTS**	
		Domestic	**Imports**	*(% of total sales)*	**Total**		*(% of production)*
Refrigerators	515	470	105	*(18%)*	575	45(3)	*(8%)*
Freezers	326	227	2	*(1%)*	229	99(5)	*(30%)*
Ranges (Electrical)	431	421	28	*(6%)*	449	10(3)	*(2%)*
Clothes Washers (Auto)	420	401	84	*(17%)*	485	19(4)	*(5%)*
Clothes Dryers (Electrical)	395	347	39	*(10%)*	386	48(4)	*(12%)*
Dishwashers	272	272	35	*(12%)*	307	0(4)	*(0%)*
Microwave Ovens	162	162	913	*(85%)*	1075	0(4)	*(0%)*

Notes:

(1) **Production = Domestic Sales + Exports**

(2) **Sales : Total and Imports from CAMA Forecast 1987**
: Domestic = Total Sales - Imports

(3) **Exports from CAMA Forecast 1987**

(4) **Exports from Statistics Canada, Personal Communications based on "Production, Sales and Stocks of Major Appliances" Cat # 43-010**

(5) **Freezer Exports = Combined Frigerator + Freezer Exports (From External Trade Division, Stats Can) - Refrigerator Exports.**

TABLE 2.2

CANADA/ONTARIO APPLIANCE COMPARISON

1986

	SALES	SATURATION RATES	
	Ontario % of National	Canada	Ontario
Refrigerators	40.7%	99.3%	98.9%
Freezers	45.9%	57.7%	58.5%
Ranges (elec.)	38.3%	92.6%	91.0%
Clothes Washers (auto)	38.2%	70.4%	NA
Clothes Dryers	38.3%	65.7%	NA
Dishwashers	39.4%	37.9%	34.1%
Microwave ovens	37.5%	33.6%(1) 44.0%(2)	33.1%(1) 44.0%(2)

Source: Trends and Forecasts - Major Appliances Industry Forecast 1987. Canadian Appliance Manufacturers Association

Notes:

(1) Spring 1986 measurement

(2) CAMA - 1986 year end estimate

2.2 Forecasts of Appliance Sales

Two forecasts of appliance sales are presented herein.

The first is the latest five-year forecast of the Canadian Appliance Manufacturers Association (CAMA) as released on February 19, 1987. This document provides actual sales for a five year period ending in 1986 and forecasts of sales for the six-year period 1987 to 1992 inclusive. These data are presented in Table 2.3: CAMA Trends and Forecasts Summary.

The second forecast is produced by the Appliances Sub-Model of the Socio-Economic Research Framework (SERF) Program, which was developed by Statistics Canada and is now operated by the Waterloo Simulation Research Facility (WATSRF) of the University of Waterloo. This model provides estimates of appliance sales (amongst many other outputs) based on housing stock, penetration rates, life-expectancy of a vintaged stock of appliances, etc. The model was calibrated to the CAMA 1986 actual sales figures and then used to project sales to the year 2000 independent of CAMA's projections.

The results are summarized in Table 2.4: SERF Appliance Sales Forecast and Figure 2.1: SERF Projected Sales. Further details of the SERF analysis are contained in Appendix B - SERF Detailed Appliance Sales Forecast.

A simple comparison of the two projections shows reasonable agreement on refrigerators, freezers, electric ranges, clothes washers, and electric dryers but wide variations on dishwashers and especially microwave ovens. Given the difficulties experienced in calibrating SERF to the CAMA actual sales figures for 1986 (as referenced in Appendix B) and the less sensitive nature of SERF to changes in the appliance market, it is felt that the CAMA projections are more reliable.

TABLE 2.3

CAMA TRENDS AND FORECASTS SUMMARY

(000's of Units)

	ACTUAL					FORECAST					
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
REFRIGERATORS	412	515	489	520	575	580	578	571	570	568	573
FREEZERS	274	281	240	229	229	230	225	225	230	240	240
RANGES (electric)	315	404	379	411	449	450	444	437	434	431	435
CLOTHES washers (auto)	359	424	416	468	485	489	489	489	491	495	500
CLOTHES DRYERS	227	326	323	367	386	391	391	391	393	397	402
DISHWASHERS	215	246	240	272	307	311	315	317	320	322	327
MICROWAVE OVENS	253	429	652	862	1,075	1,100	1,000	975	1,000	1,050	1,100
ROOM AIR CONDITIONERS	84	63	77	95	75	76	76	74	75	76	77

TABLE 2.4

SERF APPLIANCE SALES FORECAST

DESCRIPTION: Appliance sales projections from SERF DATE: 09-MAR-87 10:39

NAME: A UNITS: UNITS MAGNITUDE: 10** 0 SLICE:

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
EL. RANGE	62276	427314	441710	308279	435101	499697	509007	511148	509796	497830	481666	464169
MICROWAVE	326452	340089	354915	371526	1123505	544076	544476	565523	586530	194297	199970	206187
FRIDGE	529761	532354	541390	553486	560349	635186	644453	646283	645648	634436	619457	603669
WASHER	464075	468448	478631	493409	506182	509901	521959	527928	530353	522651	514928	500100
EL. DRYER	384453	381535	384443	392250	398941	398325	407715	413431	418014	414811	413275	404742
D/d	241763	256924	271584	287716	302344	193536	201345	207503	213082	214023	213192	211694
FREEZER	94444	193847	208082	224538	238486	247283	258165	265521	271658	271955	270247	267928
TOTAL	2103422	2600509	2680754	2631202	3564906	3028001	3037118	3137636	3175079	2750001	2712736	2658488

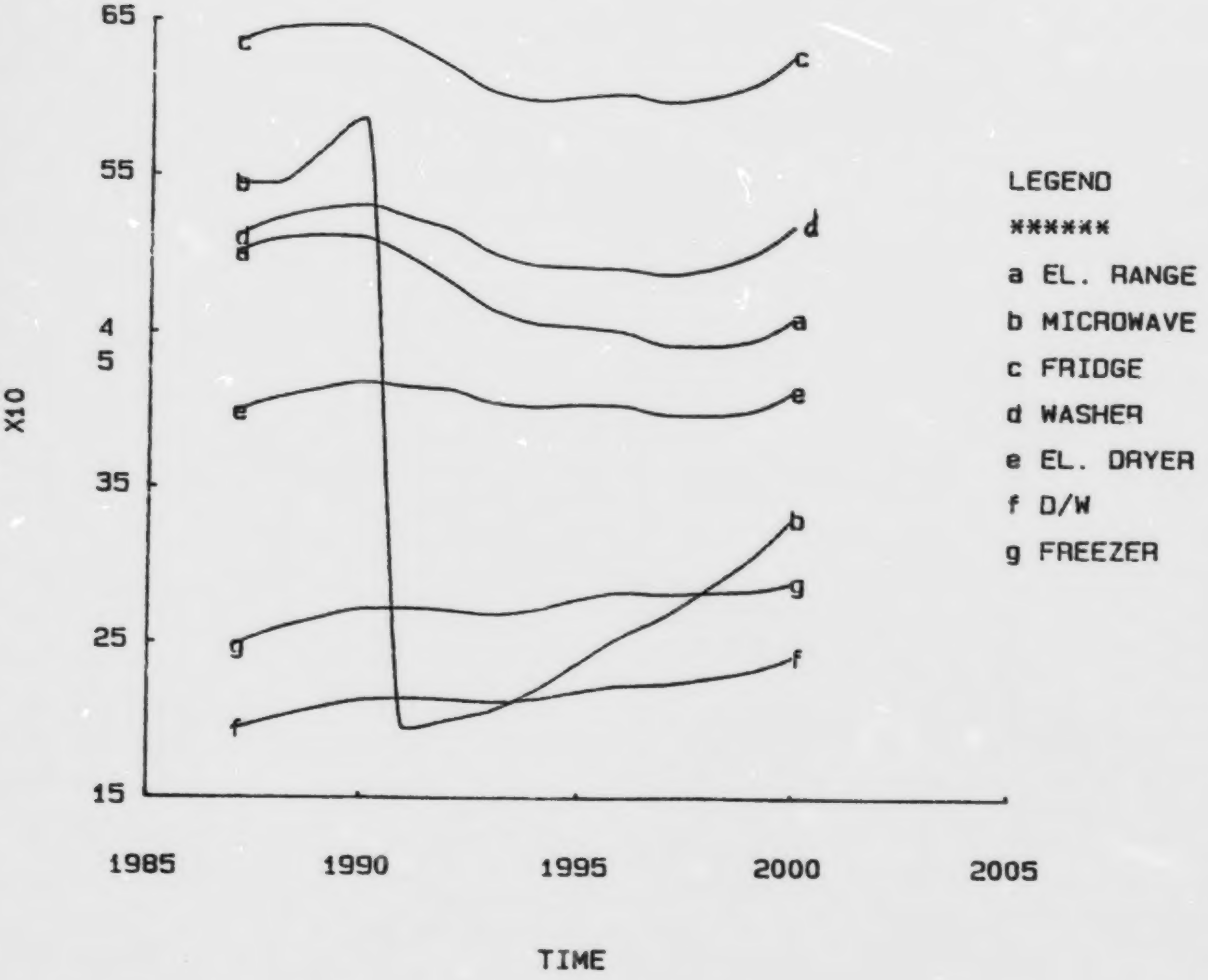
DESCRIPTION: Appliance sales projections from SERF DATE: 09-MAR-87 10:39

NAME: A UNITS: UNITS MAGNITUDE: 10** 0 SLICE:

	1994	1995	1996	1997	1998	1999	2000
EL. RANGE	455495	453554	450721	442011	441537	445083	459087
MICROWAVE	219097	236775	254120	266872	284819	304204	330131
FRIDGE	598349	601023	602728	597429	600936	608620	627768
WASHER	492650	491464	490600	486936	490871	499439	517653
EL. DRYER	402393	404130	403432	397437	396973	399959	412442
D/W	213815	218570	222537	223401	227181	232086	240895
FREEZER	271255	278076	282627	281105	282562	283822	289071
TOTAL	2653052	2683590	2706764	2695191	2724879	2773213	2877047

FIGURE 2.1

SERF PROJECTED SALES



2.3 Overview of the Appliance Manufacturing Industry

2.3.1 **Number of Companies:** The Canadian Appliance industry is dominated by three large full-line suppliers which are subsidiaries of the three largest U.S. appliance manufacturers. These three large companies (Camco, Inglis and WCI) account for about 85% of the market; the remainder is made up of three smaller companies. Table 2.5: Summary of Canada Appliance Manufacturers presents key information on those companies which manufacture in Canada. In addition, there are a number of companies which import appliances manufactured in the U.S. and offshore for sale in Canada. Some importation also takes place under the auspices of the three large companies.

2.3.2 **Size of the Industry:** Currently the Canadian appliance manufacturing industry as a whole can be characterized by the following:

- Total Annual Sales: slightly over $1 billion
- Total Direct Employment: about 7,500 employees directly in manufacture, service and administration
- Indirect Employment: about another 7,500 indirect jobs in Canada (parts supply)
- Purchase of Raw Materials and Components: about $500 million (in 1984), mostly from Canadian sources
- Number of Plants: about 24 establishments of which about 14 are manufacturing plants.

2.3.4 **Regional Distribution:** As shown by Table 2.6: Regional Distribution of Appliance Industry, Ontario is the center of the Canadian appliance industry with about 70% of the plants, employment and shipments. Quebec ranks second with about 23% of the industry. Together the two provinces account for 90 to 95% of the industry and all of the manufacturing.

TABLE 2.5

SUMMARY OF CANADIAN APPLIANCE MANUFACTURERS

Manufacturers	Products	Brand Names	Plant Locations	Parent Companies	Foreign Ownership	Share of Cdn Market	Annual Sales(3)	Number of Employees(4)
Camco Inc.*	all appliances except freezers	General Electric Hotpoint McClary Moffat S.L.	Hamilton, Ont Orangeville, Ont London, Ont(1) Montreal, P.Q.	Canadian General Electric (51%) GSW	53% Cdn 47% Foreign	40%	$512 Million	over 4,000
Inglis Limited*	all appliances except freezers	Inglis Admiral Whirlpool S.L.	Toronto, Ont Port Credit, Ont Stoney Creek, Ont(2) Cambridge, Ont Montmagny, P.Q.	Whirlpool Corp (USA) (50%+) Sears Canada Inc. (20%)	47% Cdn 53% Foreign	30%	$356 Million	2,846
W.C.I. Canada Ltd.* (White Consolidated Industries)	all appliances	Figidaire Gibson Kelvinator Roy White-Westinghouse Arctic Star S.L.	Cambridge, Ont L'Assumption, P.Q.	WCI-U.S.(100%) in turn owned by A.B. Electrolux (Sweden)	100% Foreign	15%	N/A	1,000 to 2,000

TABLE 2.5 Continued

Manufacturers	Products	Brand Names	Plant Locations	Parent Companies	Foreign Ownership	Share of Cdn Market	Annual Sales(3)	Number of Employees(4)
W.C. Wood Co. Ltd.	freezers compact refrigerators	Wood S.L.	Guelph, Ont	Same	100% Cdn	largest in freezers	$55 to $85 million	500 to 1,000
General Freezer Ltd.	freezers	Atlas General Freezer Gensave Zero Freeze, Polaris S.L.	Woodbridge, Ont	Canadian Manoir Industries	100% Cdn	?	?	200 to 500
Hoover Canada Inc.*	clothes washers compact dryers	Hoover	Burlington, Ont	Chicago Pacific Corporation, USA	100% Foreign	?	$25 to $100 million	200 to 500
						Totals:	over $1,000 million	7,500 approx in Appliances

Notes:
* members of Canadian Appliance Manufacturers Association (CAMA)
SL = Stencil lines (manufactured for major retailers)
(1) Camco's London plant is being phased out in 1987
(2) Inglis Stoney Creek plant is being phased out in 1987.
(3) Annual Sales from 1986 Annual Reports (exact figures) or from Canadian Trade Index (ranges) for all products and services.
(4) Number of Employees for 1986 from Annual Reports (exact figures) or from Canadian Trade Index (ranges) for all products and services.

TABLE 2.6

REGIONAL DISTRIBUTION OF APPLIANCE INDUSTRY

(% of Total)

	Atlantic	Quebec	Ontario	Prairies	B.C.
Establishments	3%	23%	70%	--	3%
Employment	1%	22%	67%	2%	2%
Shipments	--	23%	72%	--	1%

Source - DRIE data for the period 1980-82 for the major appliance sector (SIC-332) including the six major appliances plus microwave ovens, air conditioners, humidifiers and dehumidifiers.

2.3.5 **State of the Market:** The market for large appliances in Canada is a mature one. The potential for market growth is limited since product life averages 15 to 20 years and market saturation levels, as shown in Table 2.2, are generally high and relatively unchanging. The microwave oven is the only new product introduced in the last 15 years -- and 85% of those are imported. Aside from slight increases in product saturation in existing households, the only significant market growth results from new housing starts. Approximately 30% of sales are taken by new housing starts and 70% by replacement/additions in existing households.

Furthermore, sales in the appliance industry are strongly related to the state of the economy and to the demographics of the "baby boomers" generation. During the 1970's, when the economy was strong and household formations high, appliance sales were stable or rising and employment in the industry relatively constant.

However, the sudden rise in interest rates in the early 1980's the increase in energy prices and the decline in housing starts combined to reduce consumer demands.

This resulted in falling sales, surplus capacity and production inefficiencies. From 1981 to 1982, shipments dropped by 22% and production employment by 20%. Since then, domestic demand has improved, and projected sales for the next 5 years are essentially flat. (as shown in Table 2.3)

2.3.6 **Financial State of the Industry:** The appliance industry in Canada is a mature industry with limited potential for growth due to a market which is determined mostly by demographic trends. The industry's recent history is one of consolidation, shrinkage and the introduction of automation in an attempt to improve manufacturing efficiency and productivity. Profit margins are relatively low (in the range of 2% to 4% of sales) for the major companies. Export markets are very limited for U.S.-owned companies by vitrue of head office policy. However, smaller Canadian-owned companies have found significant U.S. niche markets (mostly in freezers and air conditioners).

Major factors in the competitiveness of the Canadian industry are the import tariffs (which now stand at 12.5% but until the beginning of 1987 were 14%) and the value of the Canadian dollar relative to the U.S. dollar.

The smaller size and shorter production runs in Canadian plants are also significant factors, resulting in lower efficiencies relative to their U.S. counterparts. Capital investment in Canadian plants is lower than in the U.S., averaging 1.4% of the value of shipments compared to 2.1% in the U.S.

2.3.7 **Degree of Foreign Ownership:** As shown in Table 2.5, the three major companies and one of the minor ones are owned and/or controlled by their U.S. parent companies. As such, they operate as branch plants or subsidiaries confining themselves primarily to a designated domestic market. The only wholly-owned Canadian companies appear to be W.C. Woods and General Freezer which produce the majority of Canadian freezers and export significant numbers of units into the U.S. market under their own brand names and those of other companies (e.g. General Electric, Hotpoint, Panasonic).

2.3.8 **Research and Development:** Throughout North America, the appliance industry is mature, with essentially saturated markets and, as a consequence, a fairly low level of R & D compared with new products in growth industries. As is typical in such industries, emphasis is placed on the introduction of process improvements to reduce costs and improve margins. Within this framework, the focus of R & D in the American industry over the last decade appears to have been on:

- improved energy efficiency
- quality improvement
- process improvement

The efforts at improved energy efficiency were the result of the energy crisis - primarily rising prices -- and efficiency legislation or threat of legislation at the state level. Now that national efficiency standards are in place, there will be a renewed commitment to further energy savings to meet the new standards. All major manufacturers also have active quality improvement programs and have been introducing new, more efficient and automated production line processes. It has been a truism that when a product is redesigned and new tooling introduced into the production process, there has generally been a jump in the energy efficiency at the same time which has allowed the particular manufacturer to "leap-frog" to a lead in energy efficiency. For the next 5 years or so, energy will likely dominate R & D efforts, but it will be linked to quality and process improvements as well.

In Canada, due to the branch-plant nature of the industry, R & D capability and investments are very low. This is particularly true of product R & D; nearly all product innovation comes from the U.S. and, even then, on a somewhat delayed time frame. What limited R & D does takes place in Canada is mostly oriented towards production line and process improvements aimed at increasing plant productivity.

As in the U.S., the cycles of investment in production processes seem also to provide opportunity for a jump in product energy efficiency. This appears to have been the case with the recent move by Inglis to its "Project 2000" refrigerators (described below). There are also indicators that other Canadian manufacturers are planning similar moves in conjunction with their next capital investment cycle.

Of the three major companies, some limited information is available on the R & D expenditures of the following:

- Camco - reports the following annual R & D expenditures:

Year	Amount	% of Total Operating Costs
1984	$1.8 million	0.47%
1985	$0.9 million	0.22%
1986	$1.25 million	0.27%

- Inglis reports investments of $12 million over 3 years in its "Project 2000" refrigerators. These regrigerators (recently marketed by Sears as the QL2000 models) have foam insulation, microprocessor controls, reduced energy consumption, fewer parts, stronger construction and use less labour and more plastic than conventional models.

The major exception to this pattern of low R & D expenditures is the small Canadian-owned manufacturers (Woods and General Freezer) which have specialized in freezer products and though both product innovation and process improvements now produce some of the most energy--efficient and price competitive freezers in the world. For example, Woods have been producing freezers with three inch foam insulated walls and high-efficiency Japanese compressors for some years now and exporting them into the U.S. market.

2.3.9 **The Changing Industry Structures:** The last decade or so in Canada has seen a large number of mergers and acquisitions in the appliance industry. At one time, there were 23 manufacturers in Canada--now there are three full-line companies. As a result of this rationalization and restructuring, the number of plants and the number of employees have fallen steadily since the late 1970's, while shipments have grown modestly. This process in Canada has been in part a quest for economies of scale and in part a response to similar mergers and acquisitions among parent companies in the United States.

2.3.10 **Tariffs and Trade:** The Canadian tariff on all major appliances was 14% in 1986 but was reduced to 12.5% on January 1, 1987. This current tariff wall protects Canadian manufacturers from foreign competition. However, despite this tariff and the 75¢ Canadian dollar, American manufacturers manage to export a significant number of appliances into the Canadian market, principally refrigerators, clothes washers, dishwashers and dryers. These imports are generally premium models with features demanded by high-end consumers (e.g., Amana refrigerators, Maytag washers and dryers, etc.). They seem to fill a market niche which Canadian manufacturers find difficult to address (given the small market for specialized lines) and do this in spite of a 12.5% tariff and a 75¢ Canadian dollar. To some degree, the economies of scale in American plants and lower U.S. manufacturing costs help these products to overcome tariff and exchange rate barriers.

Another factor affecting trade is transportation costs. Within, North America, transportation costs are not a major barrier. The U.S. appliance industry is located centrally (Kentucky, Iowa, Illinois, Indiana) and yet supplies the California market which is more distant than the Canadian market (and slightly larger). Thus, the Canadian market could easily be supplied from the U.S. Similarly, freezers produced in Canada are currently marketed throughout North America.

The situation, however, changes when overseas shipment is considered. The "density" of most appliances is low and significant shipping costs are felt to constitute a barrier to an invasion of Japanese appliances into the North American market.

In terms of tariffs faced by Canadian exporters, there does not seem to be a significant barrier. Table 2.7: Foreign Tariffs on Appliances shows that such tariffs are generally low, with the exception of Australia which has recently erected a tariff barrier to protect its domestic assembly industry. By far, the bulk of Canadian exports are to the U.S. with minor amounts to the U.K., Australia and Saudi Arabia.

2.3.11 **Company Profiles:** Corporate profiles of the Canadian appliance manufacturing companies are found in Appendix C.

2.4 Current Heating/Cooling Equipment Production and Sales

Comprehensive and current statistics on production and sales of residential heating/cooling equipment in Canada are difficult to obtain due to spotty data collection and aggregate reporting by Statistics Canada and a fragmentation of industry associations. For example, Statistics Canada stopped publication in 1984 of its catalogue No. 41-225: Heating Equipment Industry: Annual Census of Manufacturers.

TABLE 2.7

FOREIGN TARIFFS ON APPLIANCES

	U.S. (Jan. 1/87)	U.K. (EEC rate) (Jan. 1/86)	Australia
Electric Stoves	0.0	5.1	25
Refrigerators	2.9	3.8	30
Washers	2.8	5.1	30
Dryers	5.1	3.8	30
Microwaves	4.0	5.1	25
Air Conditioners	2.2	5.3	20

Also, no less than six industrial associations are involved in this area, as follows:

- Heating Refrigerating and Air Conditioning Institute - furnaces (forced air), air conditioners, heat pumps
- Canadian Institute of Plumbing and Heating - water heaters, hydronic furnaces
- Canadian Gas Association - gas furnaces and water heaters
- Canadian Appliance Manufacturers Association - room air conditioners
- Electrical and Electronic Manufacturers Association of Canada - water heaters, heat pumps
- Canadian Standards Association - testing of oil and electric equipment

Furthermore, a number of furnace, air conditioning and heat pump companies import and export significant numbers of products and these patterns change frequently. Lastly, industry overview statistics were not available from the Department of Regional Industrial Expansion.

One representation of production and sales in this industry based on Statistics Canada data (1983 and 1984) is presented in Table 2.8 - Space Heating Equipment Production and Sales.

Another set of data for furnace shipments by province (1985) from the Canadian Gas Association is presented in Table 2.9: Central Warm Air Furnaces, Shipments to Provinces, 1985.

Significant changes have taken place in the market during 1984 to 1986, namely:

TABLE 2.8

SPACE HEATING EQUIPMENT PRODUCTION AND SALES

(Shipments of Goods of Own Manufacture)[1]

	1983		1984	
	Quantity	Value	Quantity	Value
Furnaces, warm air				
. gas	116,146	$44,536K	156,848	$69,950K
. oil	15,649	$8,530K	17,148	$9,020K
. electric	11,828	$4,653K	16,030	$6,020K
Baseboard Heaters	977,998	$24,380K	808,350	$18,632K

Notes: 1. Based on Statistics Canada Catalogue No. 41-225,
Heating Equipment Industry 1984: Annual Census of Manufacturers
1980 SIC 3071 - Heating Equipment Industry

TABLE 2.9

CENTRAL HEATING WARM AIR FURNACES

SHIPMENTS TO PROVINCES, 1985

PROVINCE	GAS	OIL	ELECTRIC	WOOD/ELECTRIC
Atlantic Provinces	400	3,800	2,500	250
Quebec	2,250	2,350	8,100	400
Ontario	80,000	4,830	12,000	550
Manitoba	12,100	350	4,200	350
Saskatchewan	10,200	90	1,800	10
Alberta	21,000	380	500	--
B.C.	18,350	300	1,700	50
CANADA	114,300	12,100	30,800	1,610

Source: C.G.A. Survey

- the termination of COSP with a consequent slowdown in conversions from oil to gas and electricity;
- the leveling off and slight drop in fuel oil prices and similar trends in natural gas;
- a moderation in electricity price increases;
- an increase in housing starts.

All of this has resulted in somewhat reduced sales of gas and electric heating equipment compared with the early 1980's.

Also, fairly detailed and recent statistics for gas furnace sales by efficiency level are available from CGA and are presented in Table 2.10: Residential Gas Furnace Sales by Efficiency Level, 1986. This table segments the sales into conventional, mid-efficiency and high efficiency models (as defined by steady state efficiencies). The market share for high-efficiency (condensing) furnaces is about 24% nationally but about 31% in Ontario (which makes up 60% of national sales); which means poor sales in the rest of Canada. The industry expects market share to increase in the mid-efficiency furnaces with only limited increases in the high-efficiency range.

2.5 Overview of Heating/Cooling Equipment Manufacturing Industry

2.5.1 **Number of Companies:** There appears to be about 17 companies in Canada manufacturing residential furnaces, water heaters, air conditioners and heat pumps. In addition, there are numerous others which make wood stoves/furnaces and related equipment but these are not considered herein, nor are U.S. companies who export into Canada but have no manufacturing facilities here.

The Canadian industry exhibits the following characteristics:

TABLE 2.10

RESIDENTIAL GAS FURNACE SALES BY EFFICIENCY LEVEL

1986

		CANADA Units	%	ONTARIO Units	%
Conventional Furnace	76%-79.9% S.S. Eff.	92,000	66	51,000	61
Mid-Efficiency Furnace	80%-89.9% S.S. Eff.	14,000	10	6,000	7
High-Efficiency Furnace	90%+ S.S. Eff.	33,000	24	26,000	31
TOTAL:		140,000	100%	83,000	100%

Source: Personal Communication, Canadian Gas Association

- a few large U.S. owned companies (eg. Lennox, Carrier, Trane, York, Rheem);

- a larger number of small wholly Canadian-owned companies;

- only three water heater manufacturers (GSW, Rheem and Giant);

- a significant amount of import and export business with the U.S.;

- recent announcement of closure of Canadian manufacturing facilities by two U.S.-based companies (Carrier and York).

Table 2.11: Profile of Canadian Heating/Cooling Equipment Industry summarizes information on these companies. Individual Corporate Profiles are presented in Appendix D.

2.5.2 **Regional Distribution:** As with the appliance industry, the vast majority of heating/cooling equipment manufacturers are centered in Ontario with scattered facilities in Quebec, Manitoba, Alberta and B.C.

2.5.3 **Degree of U.S. Ownership:** As shown in Table 2.11, companies tend to be either fully foreign-owned or fully Canadian with little mixed ownership. The five large U.S.-based manufacturers (Lennox, Carrier, Trane, York and Rheem) all have manufacturing subsidiaries in Canada; although Carrier and York have recently announced a phase-out of their Canadian factories--leaving only a distribution and service network in this country. Lennox, Trane and Rheem (water heaters only) equipment continues to be manufacturered in Canada.

2.5.4 **Research and Development:** Much of the early R&D work on higher efficiency gas and oil furnaces was performed in Canada by small and active manufacturers, in some cases with technical assistance and funding from government agencies (primarily the Canadian Combustion Research Laboratoreis of EMR). As a result, these products appeared first on the Canadian market but were then quickly picked up by major U.S. companies and are now manufactured in both countries. Thus Canada's former technical advantage in this area has been lost.

TABLE 2.11
PROFILE OF CANADIAN HEATING/COOLING EQUIPMENT INDUSTRY

Manufacturers	Products	Brand Names	Plant Locations	Parent Companies	Foreign Ownership	Annual Sales	Number of Employees
Brock Engineering Manufacturing Co. Ltd.	- electric/oil/ gas furnaces - air conditioning units	"Brock"	Montreal, Que.	Same	100% Canadian	$5-25 milion	50
Carrier Canada Ltd.*	- rooftop air-conditioners - commercial/ residential air conditioning units	"Weathermakers" "Moduline" "Modupac"	Brampton, Ont.	United Technologies Corp. (U.S.A.)	100% Foreign	$25-100 million	Over 300
Clare Brothers Ltd.	- central air conditioners - gas/oil high efficiency - furnaces - heater units	"Command Air" "Whisper Air" "Megasave" "Clare Hecla"	Cambridge, Ont.	Same	100% Canadian	?	100
Climate-Master	- rooftop heating/ cooling units - non-condensing gas furnaces	"Climate Master" "Flame Master"	Toronto, Ont. Edmonton, Alta.	Bow Valley Resource Services Ltd. (Can.)	100% Canadian	?	?
Chromalox Canada	- air conditioning units - electric heating boilers - electric water heaters - baseboard heaters - heating units - heat pump compressors (I)	"Chromalox"	Cambridge, Ont. Kitchener, Ont. Rexdale, Ont. Montreal, Que.	Canadian Corporate Management Co. (Can.)	100% Canadian	$125 million	Over 1000

TABLE 2.11 CONTINUED

Manufacturers	Products	Brand Names	Plant Locations	Foreign Parent Companies	Annual Ownership	Number of Sales	Employees
Duo-Matic Olsen Inc.	- gas/oil/electric solid fuel furnaces - high efficiency gas furnaces	"Duo-Matic Olsen"	Tilbury, Ont. Richmond, B.C.	Canadian Manoir Industries Ltd. (Can.)	100% Canadian	$25-100 million	250-299
Giant Factories	- electric water heaters	"Giant" (?)	Montreal, Quebec	?	100% Canadian	?	?
Grimsby Stove & Furnace Ltd.	- oil/gas/electric furnaces	"Grimsby"	Grimsby, Ont.	Same	100% Canadian	?	35
GSW Water Products Co.	- electric water heaters - gas water heaters	"GSW"	Fergus, Ont.	Valford Holdings Ltd. (Can.)	40.3% Canadian	$25-100 million	Over 500
Keeprite Inc.	- oil/gas/electric furnaces - air conditioning units	"ICG" "Keeprite" "Lincoln" "Riviera"	Brantford, Ont. Montreal, Que. Winnipeg, Man.	Intercity Gas Corporation (Can.)	92.1% Canadian	> $100 million	Over 500
Kool-Fire Ltd.	- gas condensing furnace/heat heat pump/ air conditioning unit	"Kool-Fire"	Niagara Falls, Ont.	Same	100% Canadian	?	12
Lennox Industries Canada	- air conditioning units - gas/oil/electric furnaces	"Lennox"	Etobicoke, Ont.	Lennox Industries Inc. (U.S.A.)	99.9% Foreign	$86 million	Over 200

TABLE 2.11 CONTINUED

Manufacturers	Products	Brand Names	Plant Locations	Parent Companies	Foreign Ownership	Annual Sales	Number of Employees
Rheem Canada (1984) Inc.	- gas fired boilers - gas/electric water heaters - gas furnaces (I)	"Rheem" "Ruud"	Hamilton, Ont.	City Investing Co. (U.S.A.)	100% Foreign	$40 million	Over 70
Roberts-Gordon Appliance Corp. Ltd.	- gas furnaces - gas heating units - infared heaters	"Roberts-Gordon" "Co-Ray-Vac"	Grimsby, Ont.	ROKKOR Industries Inc. (U.S.A.)	100% Foreign	$1-5 million	30
Trane Canada Inc.	- radiant heaters - convection heating units - gas furnaces - air conditioners (I)	"Trane"	Toronto, Ont.	American Standards Inc. (U.S.A.)	100% Foreign	$60 million	250-499
Westcan Electrical Manufacturing Inc.	- baseboard heaters - wall mounted heaters	"Chaudaire" "Mark VII"	Valleyfield, Que. Brandon, Man. Brantford, Ont. Vancouver, B.C.	?	?	?	Over 500
York Air Conditioning Ltd.*	- gas furnaces - electric furnaces - air conditioners (I)	"York"	Rexdale, Ont.	York International Inc. (U.S.A.)	100% Foreign	$40-50 million	65

Notes: I = imported
* = recently announced closure of Canadian manufacturing plant

As with appliance manufacturers, the R&D facilities of the U.S.-owned companies are centered in the U.S. and technology tends to flow north if and when the market justified such changes. In the area of heating equipment, Canadian winters seem to have stimulated this flow of technical advances across the border (in both directions), however, low cooling loads and electricity prices seem to have dampened the application of high-efficiency air conditioning technology to the Canadian market. In the area of heat pumps, there has been significant investment by Canadian governments and utilities in optimizing technology and equipment for Canadian climatic conditions.

3.0 COMPARISON OF ENERGY EFFICIENCIES

3.1 Introduction

This section compares the energy consumption/efficiency of appliances and heating/cooling systems currently on the Canadian market in four ways:

- historical improvements in efficiency;
- ranges of efficiency currently on the Canadian market;
- comparison with U.S. market efficiencies;
- comparison with the new U.S. efficiency standards.

In the case of Japanese refrigerators, some spot comparisons are also undertaken.

At the outset, it must be recognized that the comparison of product efficiencies within Canada and between Canadian and U.S. (or other countries') products is hindered by two main factors:

- availability of comprehensive data;
- different testing methods which make direct comparison impossible.

This situation is illustrated by Table 3.1: Canada/U.S Efficiency Comparison Situation.

Firstly, the Canadian Energuide Program provides consumption data (historical and current) for all six major appliances which allows a comparison of historical improvements. However, such data is not available in Canada in a comprehensive manner for room air conditioners, central air conditioners and heat pumps, furnaces and water heaters. Thus, a detailed comparison of historical improvements or market availability is not possible in Canada for these products. Note, however, that a general overview of heating/cooling efficiency improvements is presented in Sections 4.2 and 4.3.

TABLE 3.1

CANADA/U.S. EFFICIENCY COMPARISON SITUATION

	DATA AVAILABILITY		INTERNATIONAL COMPARISON	
	CANADIAN DATA AVAILABLE	U.S. DATA AVAILABLE	COMPARISON POSSIBLE	DIRECT COMPARISON OF RATINGS
Refrigerators	yes(1)	yes(2)	yes	no
Freezers	yes(1)	yes(2)	yes	no
Clothes Washers	yes(1)	yes(3)	yes	no
Dishwashers	yes(1)	yes(3)	yes	no
Ranges	yes(1)	no	no	no
Clothes Dryers	yes(1)	no	no	no
Room Air Conditioners	no	yes(2)	no	no
Central Air Conditioners and Heat Pumps	no	yes(4)	no	no
Furnaces	no	yes(5)	no	no

Source Codes:

1. Energuide Program (Department of Consumer and Corporate Affairs)
2. AHAM (Association of Home Appliance Manufacturers)
3. ACEEE (American Council for an Energy-Efficient Economy)
4. ARI (Air Conditioning and Refrigeration Institute)
5. GAMA (Gas Appliance Manufacturers Association)

Secondly, U.S. consumption or efficiency ratings are available for all products except for ranges and clothes dryers (which are not covered by the Energyguide Program). Thus taking into account the availability of Canadian efficiency data, it is only possible to compare internationally four products:

- refrigerators
- freezers
- clothes washers
- dishwashers

Comments are also offered on the likely comparisons in other products.

Thirdly, the Canadian (CSA) and American (DOE) testing standards for these four appliances differ somewhat and make direct comparison of the resulting consumption data (KWh per month or per year) very difficult although a general indication of relative efficiencies can be obtained. This problem of direct comparability can be addressed by calibrating the Canadian and U.S. data by finding common appliance models rated by both test methods. This method is further elaborated in Section 3.4.

3.2 Historical Improvements

The availability of Energuide Directories of appliance ratings from the beginning of the Program until 1985 have enabled an historical analysis of appliance efficiency improvements. A number of evaluations of the Energuide Program have also examined the question of efficiency improvements (as distinct from shifts in consumer purchase patterns). As a result, there is little doubt that there have been substantial improvements in the energy efficiency of most appliances offered on the Canadian market. Table 3.2: Appliance Historical Efficiency Improvements shows the reduction in the average Energuide ratings for the six Energuide appliances (and in the case of refrigerators and freezers, for various types of these appliances) from 1978 to 1983. The most significant reductions have been in freezers (43%), dishwashers (27%), clothes washers (28%) and refrigerators (17%). There has been no improvement in electric ranges and electric dryers.

TABLE 3.2
APPLIANCE HISTORICAL EFFICIENCY IMPROVEMENTS
(average Energuide ratings, kWh/m)

	1978	1983	% Reduction
Refrigerators			
- Manual Defrost	62.1	58.7	5%
- Other 1 door	87.0	79.7	8%
- 2 dr. FF, top freezer	161.5	122.1	24%
- FF side by side	194.5	135.5	30%
- Weighted Average	138.4	115.1	17%
Freezers			
- Chest	110.1	62.1	44%
- Upright	149.3	94.4	37%
- Weighted Average	113.2	65.0	43%
Dishwashers	143.1	104.1	27%
Clothes Washers	137.3	99.3	28%
Electric Ranges	67.7	66.5	2%
Electric Dryers	96.8	96.7	0%

While some of these reductions in energy use appear impressive, several points must be remembered:

- improvements in U.S. market efficiencies appear to have been greater (eg, between 40% and 50% for refrigerators over the 1972 to 1983 period);
- much of the improvement in dishwashers and clothes washers reflects reduced volumes of hot water consumed;
- a similar analysis for the 1981 to 1986 period shows that the rate of improvement appears to have slowed down considerably.

While comprehensive efficiency ratings are not available for Canadian heating/cooling equipment, it is obvious from product literature and other industry sources that there have been significant improvements in the fuel efficiency of oil and gas furnaces from the conventional equipment (which is still on the market) to the state-of-the-art high-efficiency equipment which is also offered by many manufacturers. This improvement is shown in Table 3.3: Heating/Cooling Equipment Historical Efficiency Improvements. Unfortunately, efficiency ratings on room air conditioners, central air conditioners or heat pumps are not made readily available in Canada. However, it is believed that efficiency improvements for air conditioners and heat pumps have been minimal in Canada and that Canadian equipment compares poorly to the new U.S. minimum efficiency standards and especially to the state-of-the-art high efficiency models on the U.S. market.

3.3 Ranges of Efficiency in Canada

In order to compare the efficiency of various appliance models currently on the Canadian market, it was necessary to update the Energuide Directories issued in January 1985, which are the most recent directories available. This was done by reviewing the letters of amendment filed with Consumer and Corporate Affairs Canada (as required by the Energuide regulations) between January 1985 and

TABLE 3.3
HEATING/COOLING EQUIPMENT HISTORICAL EFFICIENCY IMPROVEMENTS

	CONVENTIONAL EQUIPMENT ON CANADIAN MARKET[1]	NEW U.S. MINIMUM EFFICIENCY STANDARDS[2]	STATE-OF-THE-ART (U.S. MARKET)[3]
OIL FURNACE *(AFUE)*	60%	78%	85-90%
GAS FURNACE *(AFUE)*	60-65%	78%	95-97%
ROOM AIR CONDITIONERS *(EER)*	6.0-7.0	8.6	9.3-12.0
CENTRAL AIR CONDITIONERS *(SEER)*	7.0-8.0	10.0	12.5-15.0
HEAT PUMPS *(HSPF)*	6.0	6.8	8.3-8.9

Notes:

1. Estimated Canadian market efficiencies for equipment of conventional design.
2. Minimum efficiency standards in U.S. National Appliance Energy Conservation Act of 1987; see Table 5.1 for details.
3. The highest efficiency models on the U.S. market in 1987; taken from *The Most Energy Efficient Appliances (1987 Edition)*, by the American Council for an Energy-Efficient

December 1986 and performing a manual updating of the January 1985 directories. This produced ratings current as of the end of 1986.

Next, in order that efficiency differences, not capacity or feature differences were being compared between models, specific groupings of type, capacity and features were chosen for comparison purposes.

These models were chosen to represent the most popular types, capacities and features, as follows:

. Refrigerators:
  - two door
  - freezer on top
  - "frost free" operation
  - separate controls for freezer and fresh food

  } Energuide Type D

  - volume of 15.5 to 17.9 cu. ft (440 litres to 510 litres)
  - no through the door features

. Freezers:
  - chest freezer
  - manual defrost

  } Energuide Type C

  - volume A: - 10.0 to 14.0 cu. ft. (283 to 396 litres)
    B: - 14.1 to 17.9 cu. ft. (399 to 509 litres)

. Dishwashers:
  - heat on/heat off option for drying (Energuide Type C)
  - hot water consumption of 29 to 39 litres per cycle
  - no internal water heating

- Clothes Washers:
  - top loading automatic
  - selection range 3,4 or 5 from Energuide (includes a cold/cold option)
  - tub capacity of 60 to 79 litres
  - no internal water heating
- Ranges:
  - conventional (not built-in) models with a width of 30 inches (75 cm)
  - conventional (four burner) top
  - regular oven capacity of 60 to 75 litres
  - no special features such as microwave
- Clothes Dryers: (Energuide Type A)
  - drying process controlled by a times set by the user
  - drum capacity of 140 to 169 litres

The data sets for these appliance types are presented in Appendix E. This information is displayed in the form of frequency distribution bar graphs in Figures 3.2 through 3.9 which follow. In each case, the number of models on the market at each level of consumption (KWh/-month) is shown by the bar graphs. Note that the bar graphs are not volume of sales (such information is not available) but rather number of models available.

3.4 Comparison with U.S. Market

In order to compare Candian models with the efficiency of models on the U.S. market, reference was made to the following listings:

refrigerators	1986 AHAM directory
freezers	1986 AHAM directory
clothes washers	1986 ACEEE listings
dishwashers	1986 ACEEE listings
ranges	no listings available (not covered by Energyguide)
clothes dryers	no listings available (not covered by Energyguide)

In the cases of refrigerators and freezers, models of similar type, capacity and features were chosen for comparison. In the case of clothes washers and dishwashers, the U.S. models represent the entire range (except for compact clothes washers) because the data available did not differentiate on the basis of capacity and features.

The data sets for the four U.S. appliances are also found in Appendix E. Similarly, the information is displayed on inverted bar graphs as the lower section of Figures 3.2 through 3.7 (again by number of models not sales volume).

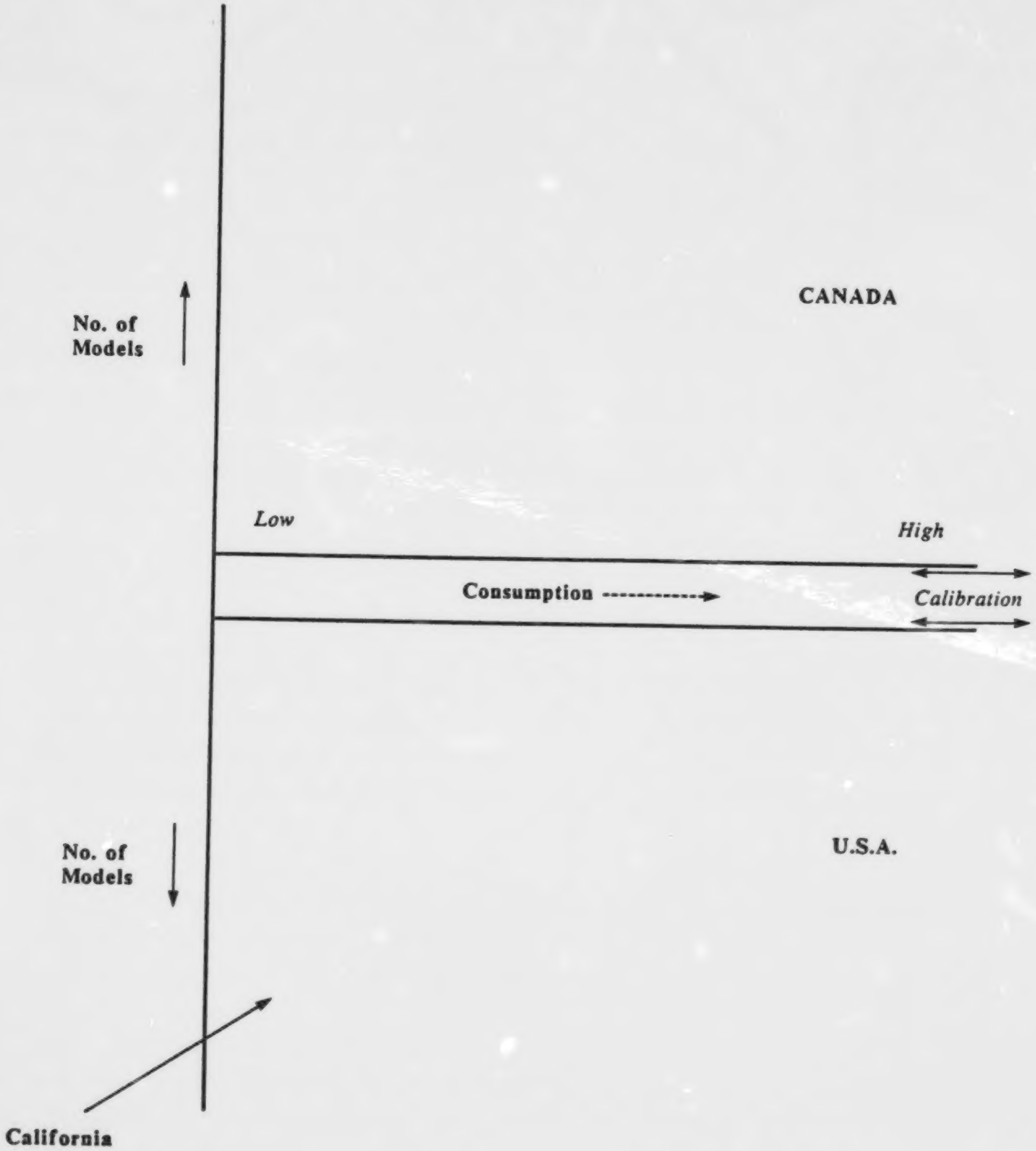
As shown in Figure 3.1: Template, this forms a diagram somewhat similar to the North American continent, with the Canadian market to the North, the U.S. market to the South; the horizontal scale (KWh/month) representing the border and the most efficient products close to California (where efficiency standards for certain products have been in place for some time).

In addition to this general pattern, Figure 3.3 displays the country of manufacture for refrigerators, showing that the most efficient refrigerators on the Canadian market are imports from the U.S.

Furthermore, in each case, a calibration of Canadian and U.S. test results is undertaken by adjusting the allignment of the Canadian and U.S. horizontal scales (KWh/month) so that they are "visually correct". This was done by identifying specific appliance models which have been tested according to both the Canadian (CSA) and U.S. (DOE) test standards and adjusting the scales to align the ratings for these models. However, this comparison of the dual test results for

FIGURE 3.1

TEMPLATE


CANADA
No. of Models
Low
High
Consumption
Calibration
U.S.A.
No. of Models
California

common models does not always yield consistent results. There is variation in the difference betweeen Canadian and U.S. test results" for models of similar ratings in either country and non-linear variation between the top and the bottom of the consumption ranges. In each case, the ratings for common models and a "proposed calibration" is displayed on a calibration table (Tables 3.4 through 3.7) immediately following the Figure for each appliance. While the selected calibration is approximate, the range of "Canada minus U.S. test results" is very narrow and (with the exception of freezers) the Canadian and U.S. test standards yield similar but not identical ratings. In freezers, the gap is wider and more problematic due to a 70% adjustment which is applied to U.S. test results, as explained in Table 3.5.

3.5 Comparison with New U.S. Efficiency Standards

The recently enacted U.S. National Appliance Energy Conservation Act of 1987 is described more fully in Section 5 of this report. However, at this point it is possible to visually illustrate the level of the standard which will come into effect in 1990 for refrigerators and freezers. This standard of maximum annual consumption, converted to KWh/month, is shown as a hatched band on Figures 3.2 through 3.5. The standard is shown as a band rather than a discrete line because the Figure covers a narrow range of refrigerator or freezer capacities and the standard (see Table 5.1) is dependent upon the capacity of these appliances. Therefore, any model within the band or to the left of the band meets the 1990 standard; any model to the right of the band does not.

The U.S. standards for dishwashers and clothes washers are related to design criteria not consumption (see Table 5.1) and are, therefore, not possible to show on the efficiency comparisons in Figures 3.6 and 3.7. The standards for ranges and clothes dryers pertain only to gas equipment (prohibiting pilot lights) and are, therefore, not relevant to this analysis.

FIGURE 3.2

REFRIGERATORS

(TYPE D, 15.5 TO 17.9 CU.FT)

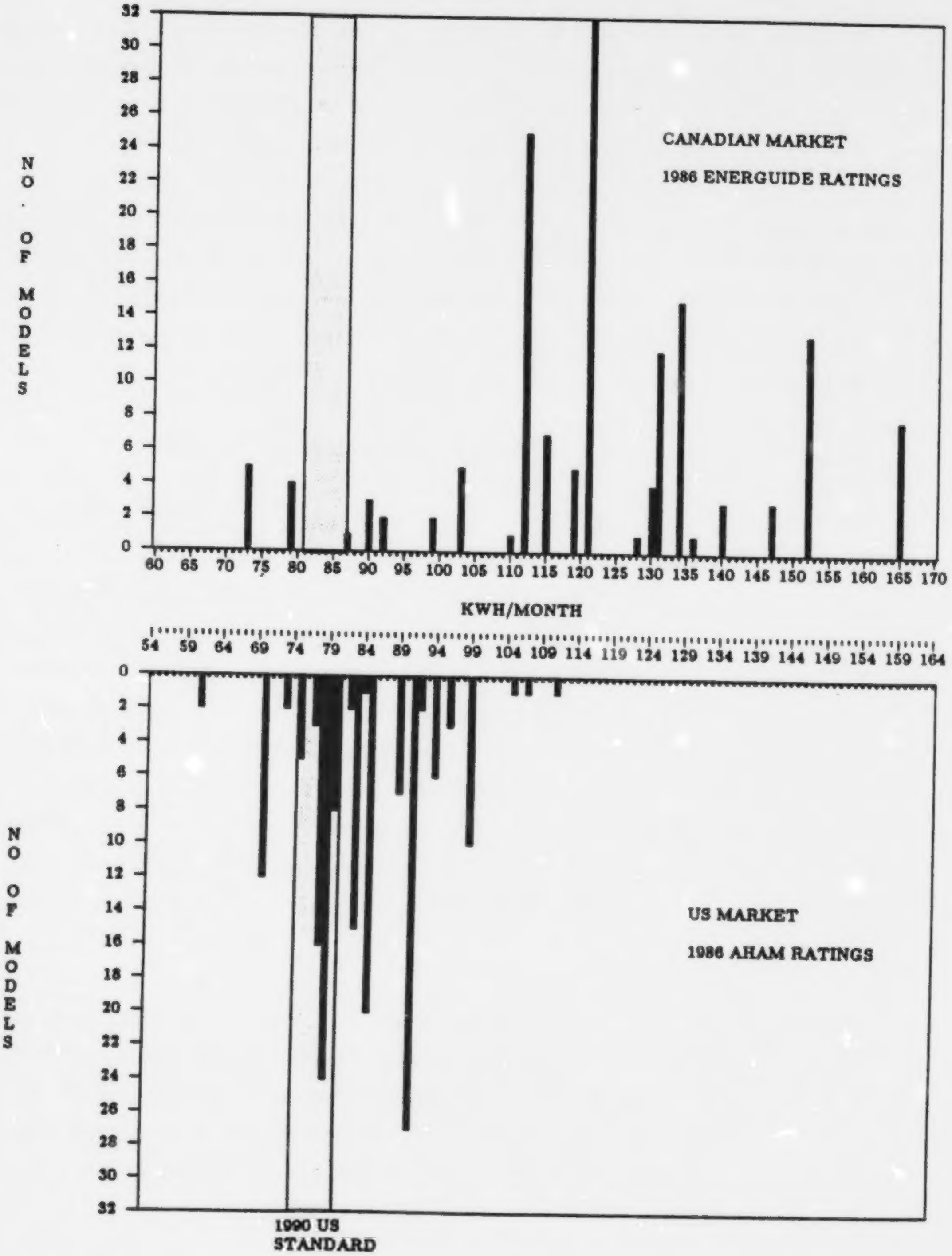


FIGURE 3.3

REFRIGERATORS SHOWING COUNTRY OF MANUFACTURE

(TYPE D, 15.5 TO 17.9 CU FT)

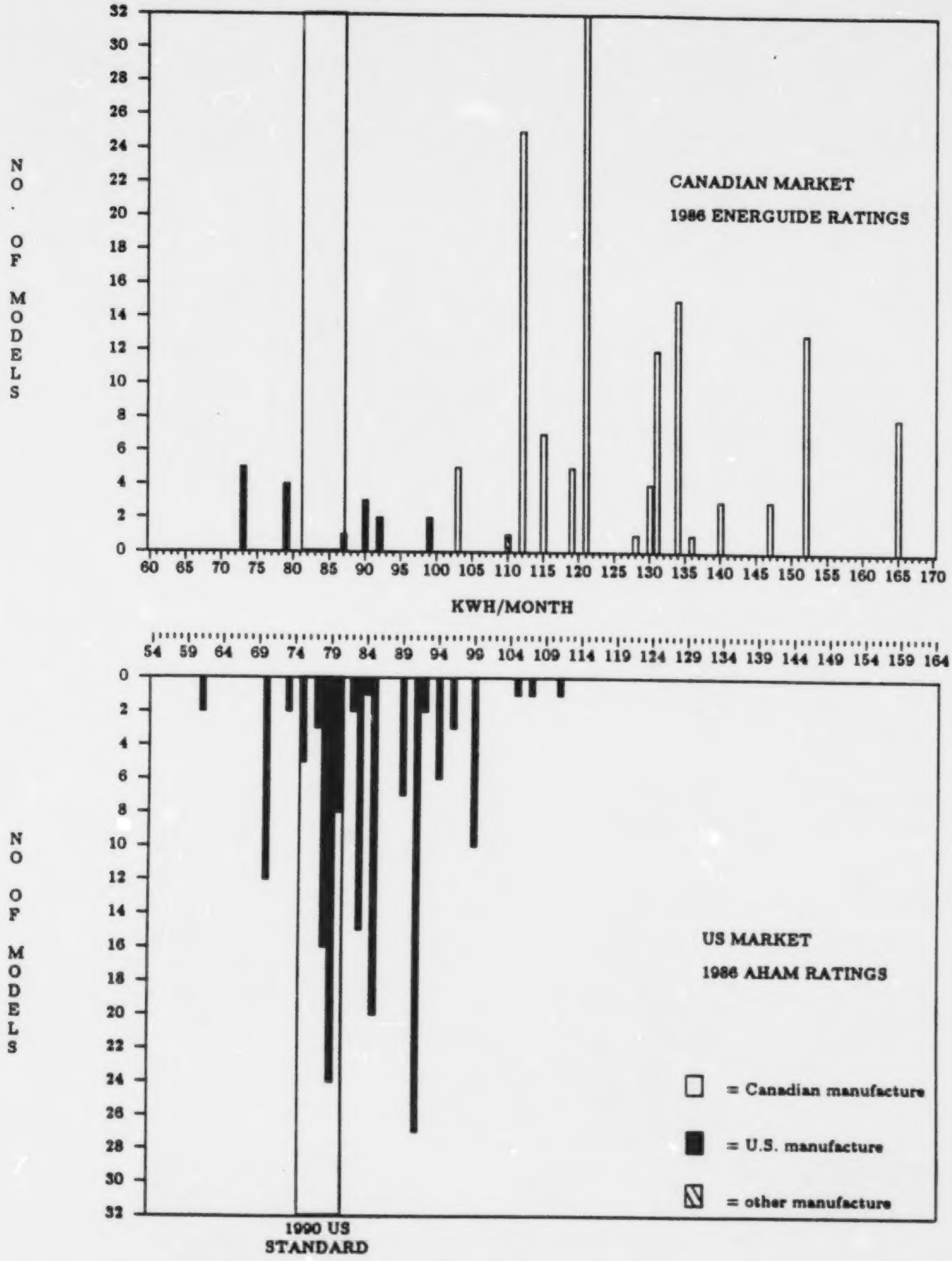


TABLE 3.4

REFRIGERATOR CALIBRATION

Brand		Models kWh/m	Cdn. Energuide Rating kWh/m	U.S. Energyguide Rating kWh/m	Cdn.-U.S. Rating kWh/m
Amana	Cdn	TR18J	73		
	US	TR18J		71	2
	Cdn	TR16G(*)	87		
	US	TR16H(*)		81	6
	Cdn	TR18G(*)	90		
	US	TR18H(*)		80	10
	Cdn	TR16J	79		
	US	TR16J		71	8
	Cdn	TM16J	79		
	US	TM16J		72	7
Norge	Cdn	CNNT178B	92		
	US	CNNT178BV		91	1
Caloric	Cdn	GFS160-1	79		
	US	GFD160-1.1		79	0
Admiral	Cdn	NT17B4S	92		
	US	BNT17B4V BINT17B4V		91	1
Proposed Calibration:			80	74	6

* The G and H model lines are the same in terms of energy consumption and both have now been phased out in the U.S. and Canada and replaced by the J line (as of late 1986).

FIGURE 3.4

FREEZERS

(TYPE C, 10 TO 14 CU FT, 283 TO 396 L)

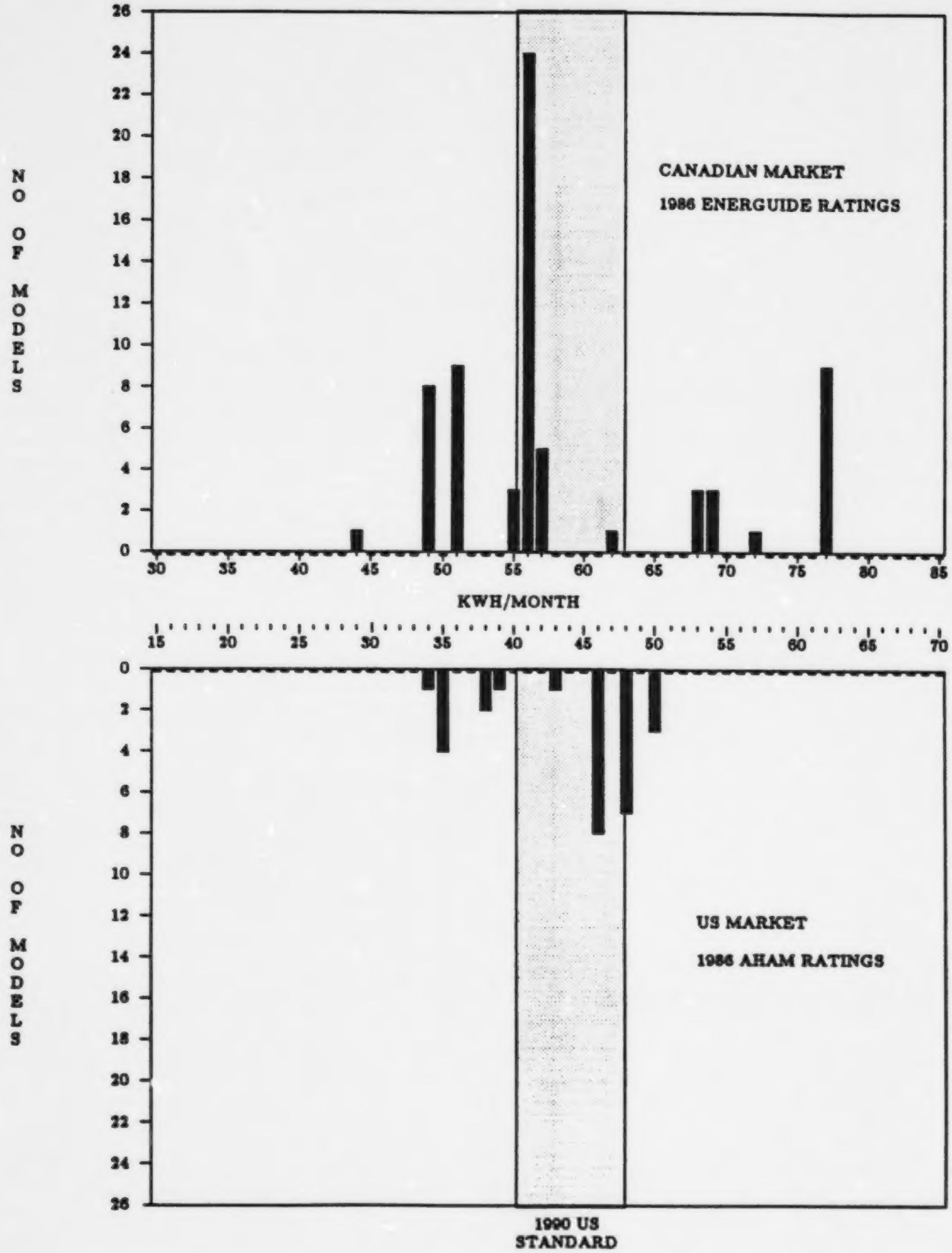


FIGURE 3.5

FREEZERS

(TYPE C, 14.1 TO 17.9 CU FT, 399 TO 509 L)

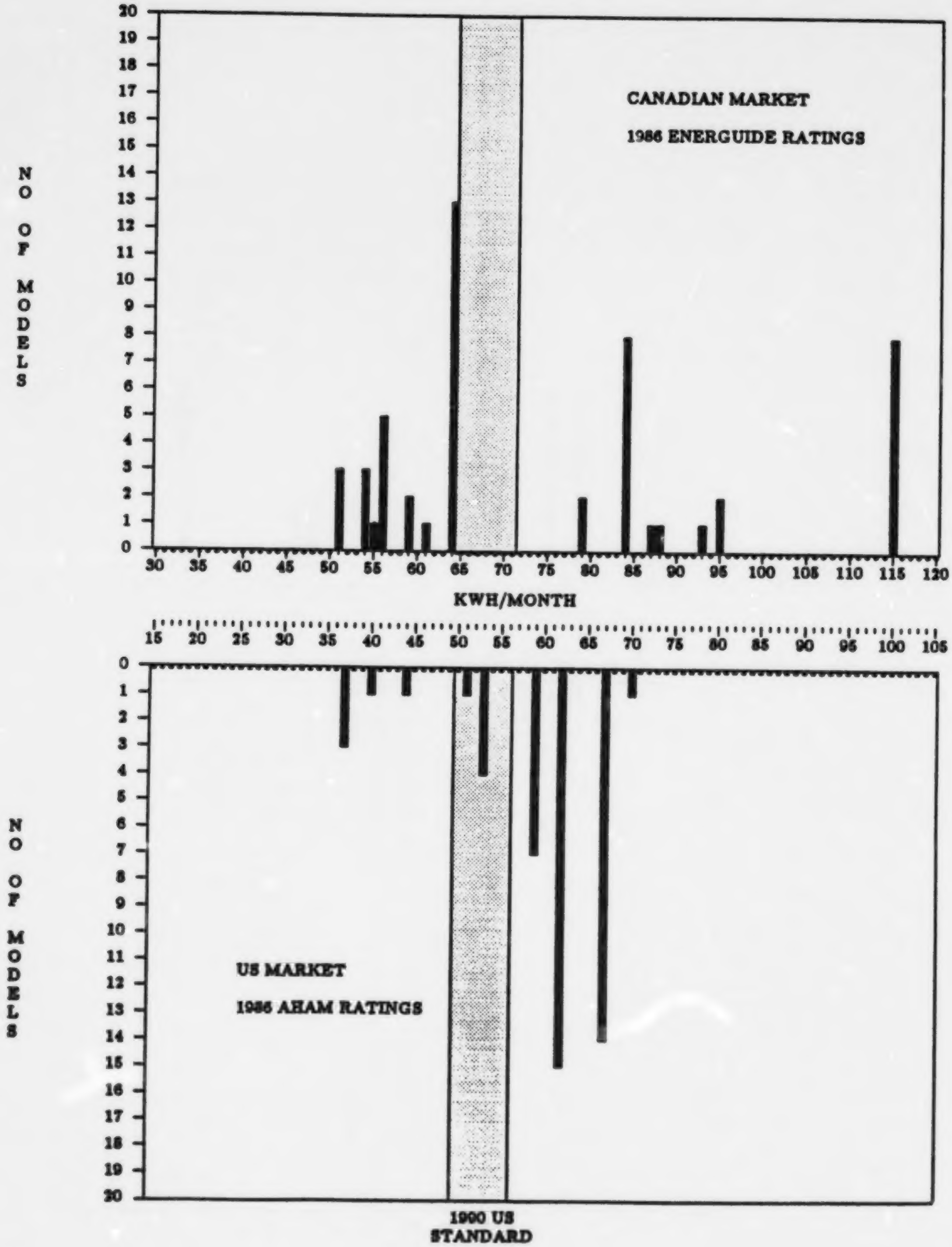


TABLE 3.5

FREEZER CALIBRATION

Based on a discussion with Geza Argay formerly of W.C. Wood Ltd., it appears that there are only minor differences between the Canadian and U.S. Test Standards for freezers, namely:

- the Canadian test is conducted at 120 V vs 115 V for the U.S. which will make compressors on Canadian tests slightly less efficient
- the Canadian test with food does not have the freezer loaded, whereas the U.S. test does. Once the food is at steady state, at which the test is conducted, this makes little difference--perhaps a slightly lower reading on the U.S. test.

The major difference, however, is that in the U.S. procedure only 70% of the measured consumption (for chest freezers) is reported whereas 100% of the measured consumption is reported in the Canadian test. The reduction in the U.S. is an attempt to reduce the 32°C ambient test temperature to a temperature more representative of the annual ambient temperature experienced in the field.

Therefore, at this point, the 70% factor will be adopted for calibration purposes and applied at a point in the lower part of the range.

Proposed Calibration: Cdn 50 kWh = U.S 35 kWh

FIGURE 3.6

CLOTHES WASHERS

(TOP LOAD; CND: 60 TO 70 L, COLD/COLD OPTION)

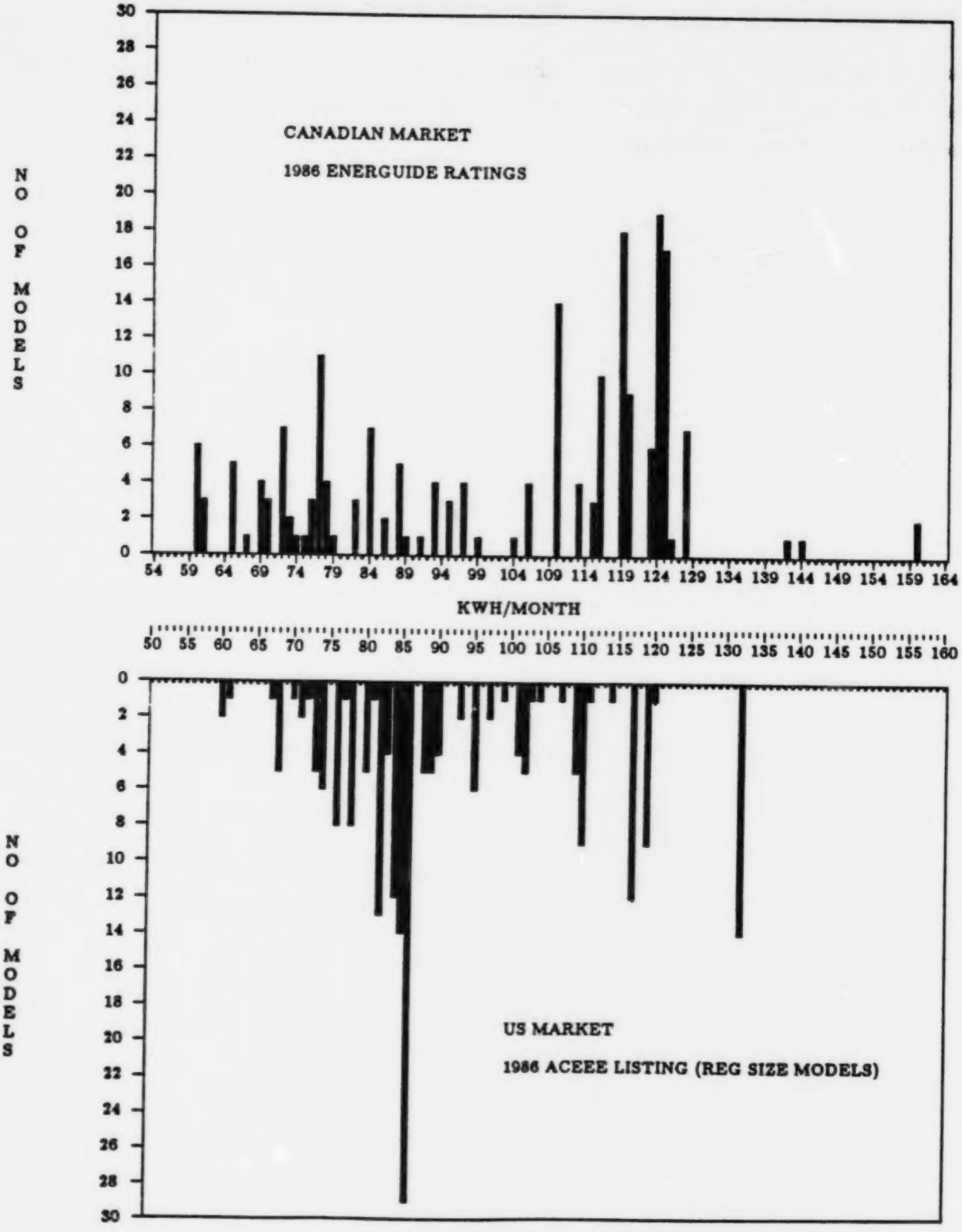


TABLE 3.6

CLOTHES WASHERS
CALIBRATION

Brand	Models kWh/m	Cdn. Energuide Rating kWh/m	U.S. Energyguide Rating kWh/m	Cdn.-U.S. Rating kWh/m
Maytag	Cdn A211S & 212S & 312S & 209S	65		
	US A212S & 312S		60	5
Maytag	Cdn A112 & 211 & 212 & 312	72		
	US A112 & 212 & 312		68	4
Maytag	Cdn A104	78		
	US A104		70	8
Proposed Calibration:		Cdn 70	US 66	4

FIGURE 3.7

DISHWASHERS

(CDN: 29 TO 39 L, HEAT ON/HEAT OFF OPTION)

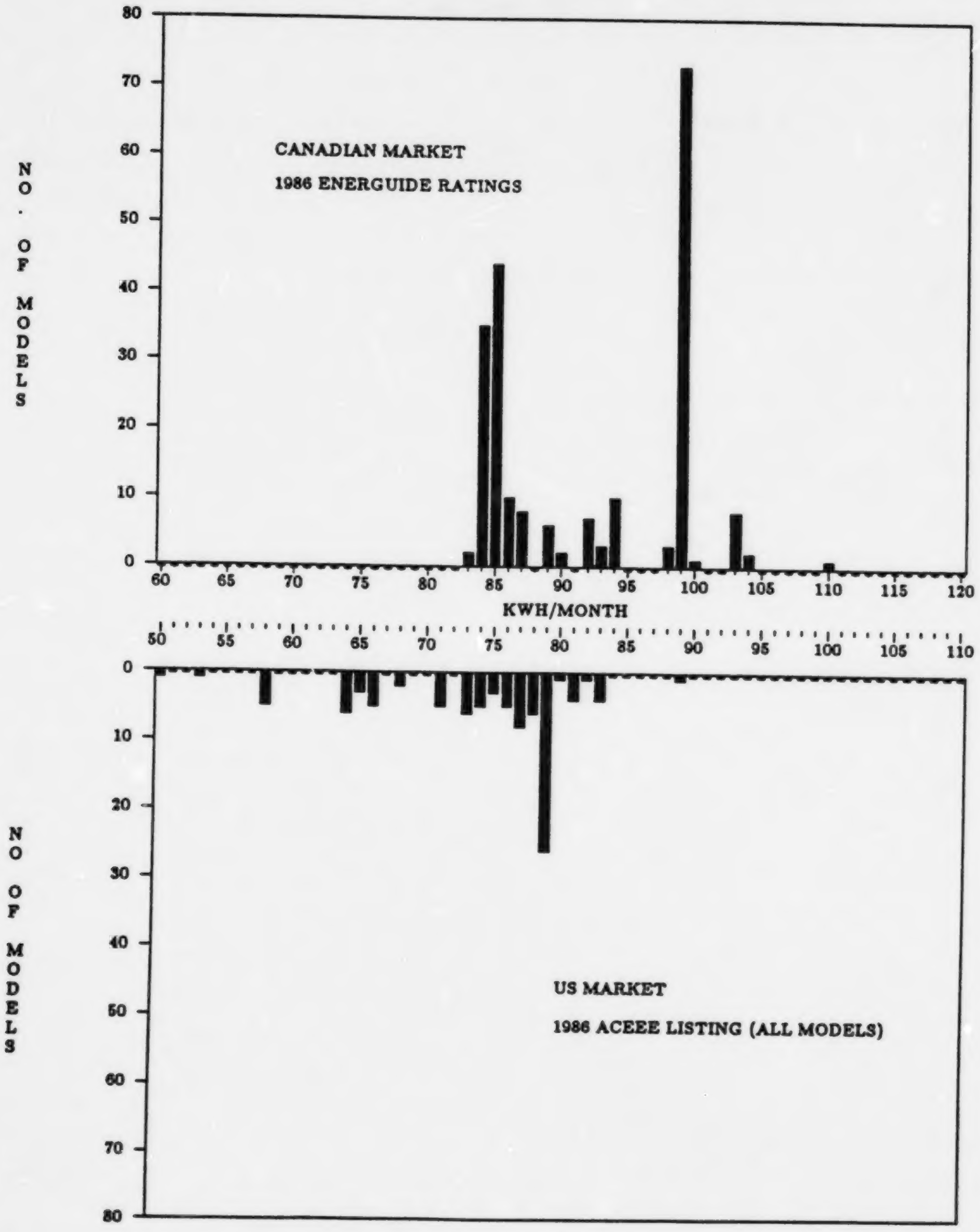


TABLE 3.7

DISHWASHER CALIBRATION

Brand	Models kWh/m	Cdn. Energuide Rating kWh/m	U.S. Energyguide Rating kWh/m	Cdn.-U.S. Rating kWh/m
Maytag	Cdn W181 & 701 & 301 & 501 & 901	87		
	US WU*02, WC*02, WU482		77	10
Proposed Calibration:		Cdn 87	US 77	10

FIGURE 3.8
RANGES
(30", 4 BURNER, 60-75 L OVENS)

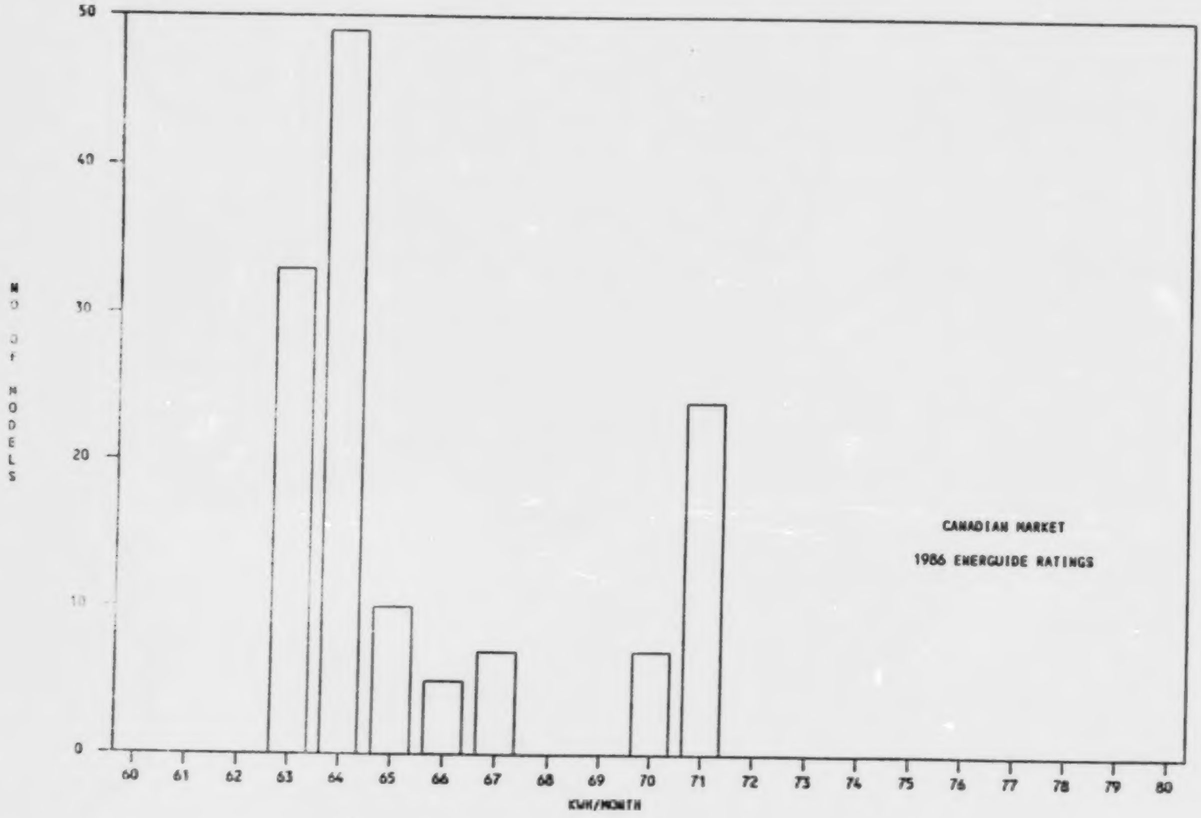
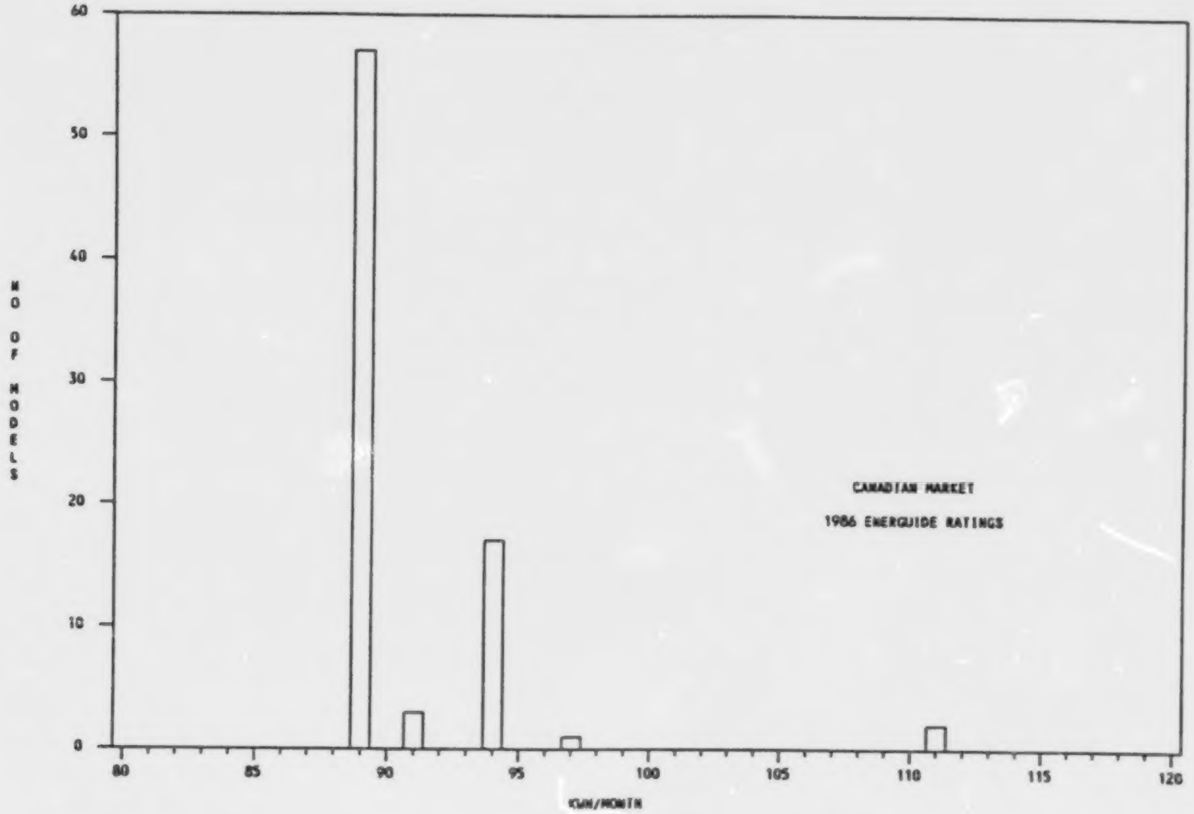


FIGURE 3.9

CLOTHES DRYERS

(TYPE A, 140-169 L)



3.6 Efficiency of Japanese Refrigerators

For several years, it has been stated that Japanese refrigerators were dramatically more efficient than their U.S. or Canadian counterparts with annual electricity consumption less than half of U.S. levels, based on a comparison of U.S., Canadian and Japanese consumption ratings. However, there are very significant differences between the Japanese test standard and the American one, as compared with minor differences between the Canadian and American procedures.

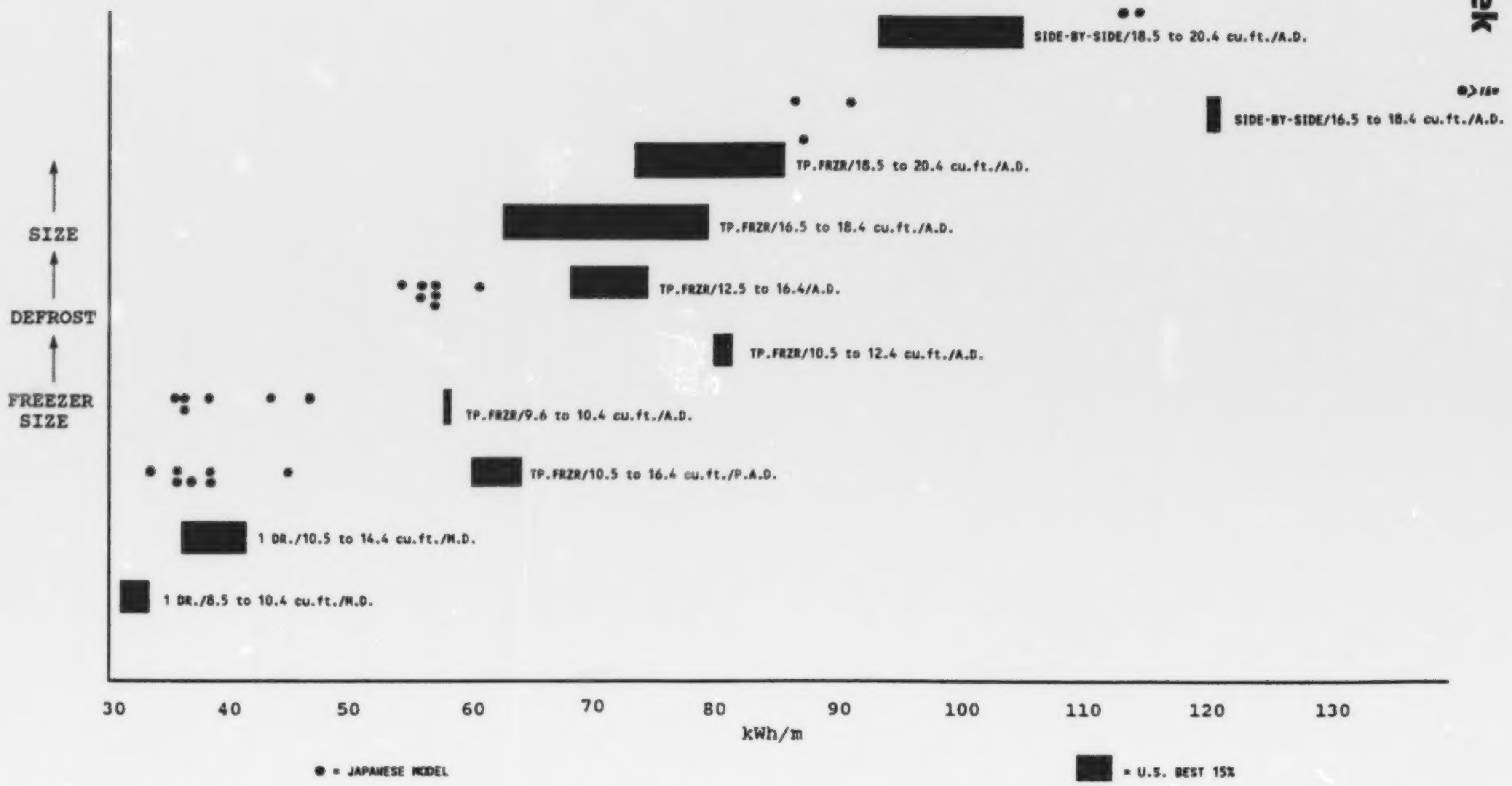
This problem began to be resolved when, in 1986, Alan Meir of Laurence Berkely Laboratories tested 12 Japanese refrigerators according to the U.S. DOE test procedure and compared the results with the Japanese ratings. It appears now that, when tested to the U.S. DOE standard, Japanese refrigerators achieve about a 45% higher consumption rating than their Japanese rating. Indeed, the formula for conversion is:

$$DOE = 1.43 \times JPN + 36$$

where DOE is the annual electricity use (KW/h year) as determined by the DOE test, JPN is the manufacturer's reported electricity use as determined by the Japanese test procedure (KWh/year) and 1.43 and 36 are constants.

Thus part of the apparent differences between Japanese and U.S. refrigerators can be attributed to different testing standards but this does not account for all of the differences. By either testing Japanese refrigerators to U.S. DOE standards or converting Japanese ratings to equivalent U.S. ratings, it is possible to compare the efficiencies of various models of similar type, capacity and features. Figure 3.10: U.S./Japanese Refrigerator Efficiency Comparison shows the consumption of 26 Japanese refrigerator models as compared with the best 15% of American 1986 models in equivalent type, capacity and feature categories. The comparison is obvious: in the smaller size ranges typical of the Japanese market (eg, under 16 cu. ft.), Japanese refrigerators are significantly more efficient than the most efficient

FIGURE 3.10
U.S./JAPANESE REFRIGERATOR EFFICIENCY COMPARISON



comparable U.S. models. In larger size ranges and in side by side freezer/refrigerators (more typical of the U.S. market) the Japanese models are similar to the best of the U.S. models but apparently not better and in some cases considerably worse.

Nevertheless, the point remains that Japanese refrigerators appear to employ technologies and techniques that make them considerably less energy intensive (by perhaps 20% to 30%) in the smaller size ranges. The technologies used in Japanese refrigerators include:

- Solid state controls
- More efficient compressor motors, with capacitor-run design and low-loss iron cores
- Efficient rotary compressors
- Reductions in friction losses and fluid-flow resistance, and improvement of volume efficiency in the compressor
- Compressor waste heat vented to the air rather than transferred to the refrigerant
- Evaporator fan motor removed from the refrigerated volume
- Condenser tubing used for anti-sweat heaters
- Lower-conductivity foam insultation
- Independent temperature control of refrigerator and freezer compartments.

Another instructive way to compare Japanese and U.S. refrigerator efficiencies is to examine the historical improvements over the last 15 years or so. Between 1972 and 1981 the energy consumption of U.S. refrigerators declined 37% for all types and 42% for top-freezer frost-free models (holding size constant). The majority of this decline (about 35%) resulted from a redesign introduced in the 1972 to 1974 period which worked its way through the entire market by 1981. But little additional progress has been made from 1981 to 1984: average efficiency increased by only 5% from 1981 to 1983.

However, the Japanese have made much larger and more continuous reductions since 1972 -- between 70% and 85% overall as shown by the following:

Manufacturer	Reduction in Energy Consumption per Litre	
	1971 to 1981	1981 to 1984
Toshiba	70%	N/A
Mitsubishi	65%	35%
Hitachi	82%	18%
National	79%	40%

In recent years, energy efficiency for a given manufacturer has tended to improve by at least 10% compared to the previous year (controlling for size). Pre-1973 Japanese refrigerators appear to have been slightly more energy consumptive than their American counterparts, while current models have made much greater progress toward energy conservation.

As impressive as the current Japanese refrigerator efficiencies and their historical improvements are in comparison with U.S. products, they are even more impressive when compared with Canadian produced refrigerators. Canadian levels of efficiency lag behind those in the U.S. and our degree of historical improvement appears to be considerably less, making the gap with Japanese refrigerators even greater.

3.7 Costs and Benefits of Improved Efficiency

While a detailed examination of the costs and benefits of improved energy efficiency in appliances and heating/cooling equipment is beyond the scope of this project, it is worthwhile identifying the distribution of costs and benefits, looking at one example of the magnitude of costs and benefits and noting one significant difference between the Canadian and U.S. situation.

Table 3.8 - Distribution of Costs and Benefits from Increased Appliance Efficiency summarizes the type of cost or benefit, on which group they fall and the qualitative balance of costs and benefits for each group.

Manufacturers bear the incremental costs of high-efficiency components, materials or assembly (which are usually not substantial) but they pass on all of these costs to the retailer and consumer. By increasing energy efficiency, manufacturers have the potential to improve sales and market share. On balance, especially given the ready ability to pass costs through, energy efficiency can be positive for manufacturers.

The retailer faces a somewhat higher purchase price for energy efficient models but recovers this in a higher sales price. Also, since the wholesale and retail levels mark up factory prices by about 2.5 times to the consumer, the absolute amount of profit on a higher priced model is generally greater. On balance, retailers should benefit from improved energy efficiency.

Consumers face slightly higher prices for energy-efficient products but in all cases examined to date these costs were more than offset by reduced energy costs over the lifetime of the product. There, of course, would be levels of efficiency that are not cost-effective for the consumer but it is not believed that we are near that point in Canada (despite our lower electricity rates as described below).

Utilities face no costs from higher efficiency products but the reduced energy consumption and demand should be seen (particularly in capacity-short and high operating cost utilities) as a benefit in terms of reduced demand and reduced capital requirements for system expansion. Utilities are potentially major beneficiaries of increased product efficiency.

TABLE 3.8

DISTRIBUTION OF COSTS AND BENEFITS FROM INCREASED APPLIANCE EFFICIENCY

	COSTS	BENEFITS	BALANCE
Manufacturer	incremental production costs (pass through)	market share	+
Retailer	increased purchase cost 2.5x	increased sales price and profit	+
Consumer	increased retail costs	reduced energy costs over lifetime	++
Utilities	nil	reduced demand reduced capital requirements	++
Foreign Exchange	foreign sourcing	product exports	neutral
Society Overall	increased retail costs	reduced energy operating and capital costs	++

In terms of foreign exchange, building more energy-efficient appliances may mean increased foreign sourcing for components (such as Japanese compressors) but, on the other hand, tends to increase exports due to increased competitiveness in foreign markets (as has been the case with Canadian freezers) and to protect domestic markets. On balance, improved product efficiency by domestic manufacturers will probably have no net effect on the balance of payments.

Overall from a societal view, an increase in product efficiency means a tradeoff between increased retail costs for products at the time of purchase and the benefit of reduced energy operating costs to the consumer and reduced energy system capital costs to the utility over the lifetime of the product. It is lifecycle costing at a societal level and, on balance, appears to be strongly positive.

As one example of the magnitude of costs and benefits from the consumer perspective, Table 3.9: Magnitude of Benefits and Costs - Refrigerator Case Example shows the implications of a consumer selecting a model A at 150 kWh/month near the top of the consumption range from Figure 3.1 versus model B at 100 kWh/month near the bottom of the consumption range. Model B may cost up to $50 more to buy (likely less) but within a year it saves $30 in electricity and $450 over a 15 year lifetime (even assuming no increase in electricity rates). Thus the payback period for selecting the more efficient refrigerator is a maximum of 1.7 years and the benefit/cost ratio over the product life is at least 9. If similar scenarios were constructed for the other five household appliances (which generally don't consume as much as refrigerators and for which the efficiency ranges are not as great), the total annual electrical savings possible might be three times that for refrigerators or in the area of $100 per year at current prices.

Lastly, in undertaking economic analysis of costs and benefits and in comparing Canadian product efficiency levels with those currently in the U.S. market or in U.S. legislation, account must be taken of the higher rates for electricity in the United States and the higher

TABLE 3.9

MAGNITUDE OF BENEFITS AND COSTS - REFRIGERATOR CASE EXAMPLE

SAVINGS:

Model A:

150 kWh/m X 5c/kWh x 12 months = **$90 X 15 years = $1,350**

Model B:

100 kWh/m X 5c/kWh X 12 months = **$60 X 15 years = $900**

Annual Saving	**= $30**	**Lifetime Saving = $450**	

COSTS:

Retail cost difference:	**$50**	**$50**
Payback =	**1.7 yrs**	**B/C = 9**

TABLE 3.10

COMPARISON: CANADIAN/U.S. ELECTRICITY COSTS
(1986 January to October)

	CANADA	U.S.A.
Average Residential Price of Electricity (Secondary Energy)	5.04c/kWh	7.8c/kWh
Social Opportunity Cost (Primary Energy)	3.79 to 5.27c/kWh	5.02 to 7.3c/kWh:* fossil fuel 3.0 to 5.6c/kWh:* nuclear

* *Commonwealth Edison estimates*

marginal costs for new generation (social opportunity costs). These higher costs in the U.S. as shown in Table 3.10: Comparison: Canadian/ U.S. Electricity Costs mean that energy efficiency will be more cost-effective in the U.S. than in Canada. This must be borne in mind.

3.8 Conclusions

Based on the various comparisons, undertaken above, of the efficiency of appliances on the Canadian market in 1986, the following conclusions can be drawn:

3.8.1 Refrigerators:

- There is a very wide range of efficiencies on the Canadian market, 73 to 165 kWh/month compared to a narrower range on the U.S. market, 61 to 111 kWh/month.
- Average efficiency on the Canadian market in 1986 is significantly less than on the U.S. market.
- The efficient refrigerators on the Canadian market in 1986 (73 to 99 kWh/month are all imports from the U.S. (Amana, Caloric, Norge, Magic Chef).
- No Canadian built refrigerator in 1986 met the 1990 U.S. standard.
- The least-efficient U.S. refrigerator (111 kWh/month) is more efficient than half of the models on the Canadian market.

However, it is important to note that for the 1987 model year, Sears in Canada has introduced a new line of more efficient Kenmore refrigerators -- the "Q.L. 2000" series. These models are built in Canada by Inglis and feature foam insulation and (with the exception of the budget models) electronic controls.

All of the "Q.L. 2000" series models have an Energuide rating below 100 kWh/month, meaning that for the first time a Canadian refrigerator of this type and capacity has broken the 100 kWh/month barrier. The 16.5 cu. ft. model with upper frost-free freezer, which is comparable to those models considered in Figure 3.2, is rated at 84 kWh/month for the electronic version and 86 kWh/month for the budget version. These ratings would put it slightly above the 1990 U.S. Standard for that size and type which would be about 82 kWh/month on the Energuide scale. Other Canadian manufacturers are expected to follow this lead in the next year or so.

3.8.2 Freezers:

- Canadian-made freezers appear to be generally as efficient as those on the U.S. market.
- There are significant exports of freezers (especially high-efficiency freezers) from Canada to the U.S.
- There still appear to be some rather inefficient freezers on the Canadian market (in contrast to a narrower range in the U.S. market).
- About half of the Canadian freezers meet the U.S. 1990 standard.
- Freezer energy consumption in Canada has shown very significant reductions over the last 10 years (43% or greater), more than any other appliance.

3.8.3 Clothes Washers:

- Efficiencies appear to be comparable on the Canadian and U.S. markets.
- Historical improvements in Canada have been notable at 28% but most of this is in hot water reduction.

3.8.4 Dishwashers:

- Efficiencies in the Canadian market appear to lag behind the U.S. market significantly.
- There are some very efficient models on the U.S. market that are not available in Canada.
- Conversely, there are large numbers of inefficient models in Canada that are not available in the U.S.
- The historical improvement in Canada has been 27% or more and most of this is attributable to hot water saving.

3.8.5 Ranges:

- Ranges on the Canadian market display quite similar efficiencies.
- The historical improvement has been minimal at 2%.

3.8.6 Clothes Dryers:

- There is a modest range in the efficiencies of electric clothes dryers in Canada.
- There has been no historical improvement in dryer consumption.

3.8.7 Japanese Refrigerators:

- In the smaller size ranges, Japanese refrigerators are very energy efficient and far ahead of anything made in Canada.
- In the larger size ranges, Japanese refrigerators are comparable to the best of the U.S. models and significantly better than any Canadian models.

4.0 POTENTIAL FOR EFFICIENCY GAINS

4.1 Kitchen and Laundry Appliances

4.1.1 **Introduction:** The materials presented below on future developments in the energy efficiency of kitchen and laundry appliances were integrated from information in about a half-dozen reports, each of which was itself an attempt to survey the field for one or more of the appliances under study. The principal sources of information are listed in Appendix A - Bibliography

Attention is restricted to electrical appliances and to size ranges relevant to residential use. Only a small proportion of Canadian appliances are powered by natural gas or propane. This proportion could increase in the future if electrical prices rise proportionately more than gas prices, but, until such a trend is evident, detailed study of gas appliances is not warranted. Major savings are possible with the larger sizes of kitchen appliances in restaurants and cafeterias and with laundry appliances in laundromats and institutions. However, review of commercial-scale appliances is beyond the scope of this study.

There is a further limitation to the nature of the information presented in this part of the study: viz., the information defines prospective energy efficiency levels for the appliance treated alone; no attempt has been made to determine energy savings after integrating the appliance into a house or apartment. Depending upon the specific situation and the season, increased energy efficiency in an appliance may increase or decrease space and water heating requirements. (In no case, to our knowledge, are the increases so large as to offset the savings from improved appliance efficiency.)

Throughout the study, each appliance is treated as a unit. It is not assumed that each new way of saving energy is simply additive to other ways. Quite the contrary: most are overlapping, others have interactive effects, and still others are mutually exclusive. Such effects are taken into account. Moreover, for those appliances using hot water, the energy to heat the water is included as part of the energy efficiency calculations. Finally, in some cases, specific new techniques may have positive or negative effects on other characteristics of the appliance. For example, options that reduce the need for defrosting a freezer or refrigerator will avoid excessive drying out of food, and therefore keep it fresher longer; similarly, humidity sensors in clothes dryer will reduce static build-up in clothes. On the other hand, some low-electricity options increase water consumption or reduce capacity. Where the existence of such effects has been identified, a notation is made in the tables.

In all cases, it is useful to define a specific model type for an appliance in order to compare it with other similar models. Most important, energy use tends to increase, though not proportionately, with capacity. Thus, energy efficiency should be compared only for, say, refrigerators within a specific size range. The following defines the "standardized appliances" used when comparisons of this type are appropriate.

Refrigerators

- Type D: Two door, freezer on top and "Frost Free" operation; separate controls for freezer and fresh food.

- Volume of 15.5 to 17.9 ft^3 (440 to 510 litres) including both the freezer and the fresh food sections.

- No through-the-door features.

Freezers

- Type C: Chest freezer with manual defrost.

- Volume of: A 10.0 to 14.0 cu. ft. (283 to 396 l)
  B 14.1 to 17.9 cu. ft. (399 to 509 l)

- Freezing capacity at least 5.5.

Ranges

- Conventional (ie, not built-in) models with a width of 75 cm (30 inches).
- Conventional (four burner) top.
- Regular oven with a capacity of 60 to 75 litres (2.1 to 2.6 ft^3).
- Special features, such as microwave option, not included in ratings.

Dishwashers

- Type C: Heat On/Heat Off option for drying.
- Hot water consumption 29 to 39 litres. (Energy to heat hot water included in energy consumption rating.)
- No internal water heating.

Clothes Washers

- Top loading type.
- Selection range 3,4 or 5 (ie, includes a cold/cold option).
- Tub capacity of 60 to 79 litres (2.1 to 2.8 ft^3).
- No internal water heating.

Clothes Dryers

- Type A: Drying process controlled by a timer set by the user.

. Drum capacity of 140 to 169 litres (4.9 to 6.0 ft^3).

Three sets of information are presented for each of the six appliances under study. First, a page or so of text is provided simply as background to understanding the energy use in the appliance. Second, a table shows the status of existing models of that appliance and lists possible changes to improve energy efficiency under four categories:

- measures that are likely cost-effective now;
- measures that are fully developed but too expensive at current costs and prices;
- measures that require further technical development but that are essentially extensions of existing approaches;
- measures that represent new approaches or new technologies for the service being provided by the appliance.

Lines between adjacent categories are not always clear. For example, some measures may be too expensive simply because the technology is not well enough advanced. Nevertheless, the four categories define conceptually different stages of development that can be usefully distinguished. Determination of cost-effectiveness is based on information in the references listed in Appendix A after adjusting for differences in U.S. and Canadian dollars ($1 U.S. = $1.33 CAN, rounded) and electricity costs. Canadian electrical prices were taken as 5¢ per kWh and a payback of 10 years--in effect, a 7% real rate of return--as appropriate for householders. In most cases, measures are evaluated individually, but in some cases compatible collections of measures are evaluated as a group with net energy savings (i.e., with allowance for interactions) and costs indicated. Cost-effectiveness is defined exclusively from the point of view of the consumer. No credit is taken for reduction of utility peak loads or other system savings.

The table also provides whatever information is available about the energy gains from introduction of that measure and the costs of the measure (at the manufacturer's level; i.e., excluding the mark-ups, which typically run to 150%). In a few cases, added installation costs must also be considered. However, no attempt was made to calculate rates of return except to the extent that they are implicit in the four categories. Note that more highly rated existing models (i.e., those with lower Energuide numbers) probably already include some of the measures identified as cost-effective. Hence, for rough calculations of overall impact, percentage reductions should be taken not from the best appliance on the market but from some middle point in the range.

Third, a figure is provided that attempts to show diagramatically the information in the tables. Energy use is shown on the vertical axis and the possible date of introduction of specific measures or group of measures is shown on the horizontal. Where measures are mutually exclusive, they appear as separate lines on the graph. Of all the information presented, that on date of introduction of the new technology is the most tenuous. Among other things, the technical developments described could occur anywhere in the world, whereas their introduction will depend upon marketing decisions in (or for) Canada.

Some of the approaches shown in the tables below are quite widely applicable. In particular, the energy efficiency of all major appliances can be improved with use of better motors, compressors, pumps and fans. Gains of 10% to 20% are readily achievable today, and figures up to 45% for a high-efficiency motor-compressor have been reported. For motors that operate intermittantly during a cycle, as with clothes washers, the addition of a power factor controller can increase energy efficiency by 25% to 35%. The importance of these gains in efficiency increases as the proportion of energy represented by motors, compressors, pumps and fans increases relative to total appliance energy use. Thus, they are less important with those appliances for which hot water is the primary energy input. The gains also grow with use of the appliance, which means that they are of even greater interest in commercial than in residential applications.

4.1.2 **Refrigerators and Refrigerator/Freezers:** Apart from space and water heating, refrigerators or refrigerator/freezer combination units are the largest users of energy in the residential sector. Given the range in sizes, defrost cycles, options for combination or separate units, and for design of combination units--to say nothing of special features such as ice making--there are without doubt more refrigerator models available to the public than any other major appliance. Because they are increasingly common, even in houses with a separate freezer, the focus in this section will be on refrigerator/freezer combinations with frost-free operation (slightly different from what was formerly called automatic defrost). Comparisons in this section assume combined refrigerator and freezer capacity of 15.5 to 17.9 ft^3 (440 to 510 litres).

Not only has the energy efficiency of refrigerators and refrigerator/freezers improved significantly in the past decade--by up to 33% per unit or 70% per litre of capacity--but they represent the one class of appliance for which there is unanimous opinion that further gains--commonly stated to be about 50% of current use--are both technically and economically feasible.

Heat gains in a refrigerator/freezer are as follows: through the walls 57%, heaters and fans 23%, gasket areas 12%, food 6%, and door openings 2%. Clearly, the effort to increase efficiency should focus on insulating the cabinet and improving (or, where possible, eliminating) the motors, compressors and fans that operate the unit.

Currently, the best refrigerator/freezer on the U.S. market in the size range being considered has a U.S. Energyguide rating of 732 kWh/year, or about 67 kWh/month in the Energuide system. Given that this refrigerator costs no more than others in its size class, the improvements are quite evidently cost-effective.

For the most part, the additional improvements proposed for refrigerators represent extensions of existing approaches. None incorporates a truly radical method of refrigeration, though some do require further technical development. In prototype designs, a combination of measures has been applied to refrigerator/freezers that, without altering the service provided, would cut Energuide ratings to levels of 20 to 40 kWh/month, or half those of the very best units now on the market. These designs incorporate certain features found on some European models, notably separate compressors and defrosting systems for the refrigerator and the freezer compartments, something which not only saves energy but avoids dessication of fresh food and thus improves its quality. Under this system, the refrigerator defrosting system operates simply by leaving the compressor turned off until the evaporator reaches a temperature above freezing.

Because of the wide range in refrigerator and refrigerator/freezer designs, some of which incorporate one set and some another set of efficiency improvements, it is difficult to determine which changes are and which are not cost effective. Indeed, cost effectiveness may be determined not so much by any one change as by the collection of them and their optimization within the unit. Therefore, categories in the accompanying tables are more tenuous, and the selection of possible technical measures less complete, for refrigerator/freezers than for the other appliances discussed. However, relatively few of the options are conflicting (though cost effectiveness will interact) so no truly diverging paths appear. Energuide ratings below 30 kWh/month could appear in the mid-1990s.

TABLE 4.1: REFRIGERATOR FREEZERS: EXISTING SITUATION AND POTENTIAL FOR IMPROVEMENT IN ENERGY EFFICIENCY

CANADIAN BASE *

Range of available models (1986): 73 to 165 kWh/m
Range of available models (1981): 99 to 177 kWh/m

OPTIONS FOR IMPROVEMENT

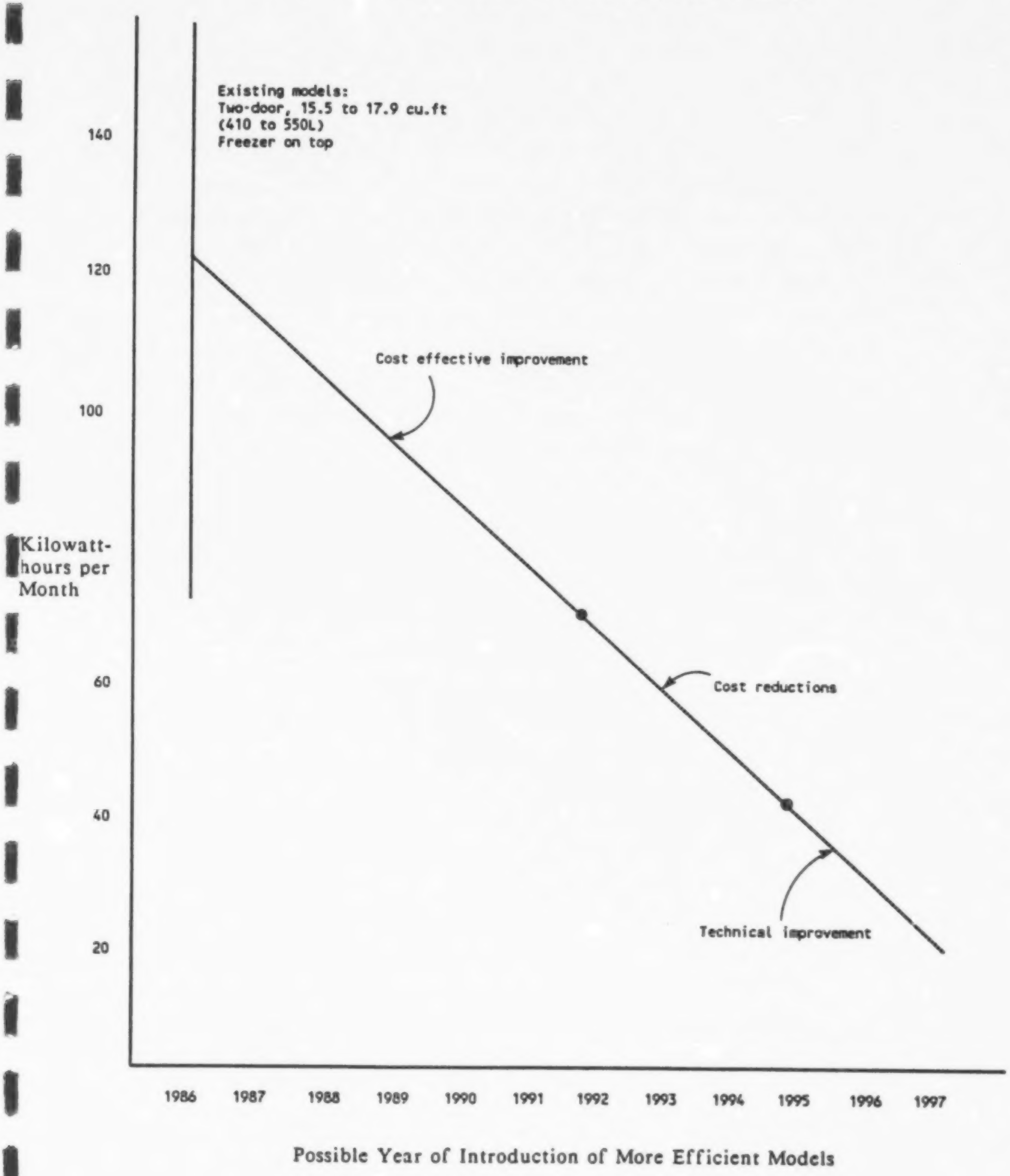
Category and Measure		Percentage Savings for Typical Units (non-additive)	Manufacturing Costs ($/unit)	Effects on Non-energy Characteristics
COST EFFECTIVE NOW				
Added and improved insulation		20 to 35%	$35	
Better door seals				
Anti-sweat heater switch				
More efficient motors, compressors and fans				+
Fewer defrosting cycles				+
Replace remaining fibreglass by foam insulation				
EXISTING TECHNOLOGY WITH COST REDUCTIONS				
High efficiency compressors§	10	20	$100	
Relocate evaporator fan outside refrigerated space§	3 to 5			
Larger evaporator area§	5 to 10			
Increased heat capacity in heat exchanger	5			
Improved air distribution				
Dual compressor system§	30 to 35			+

Category and Measure	Percentage Savings for Typical Units (non-additive)	Manufacturing Costs ($/unit)	Effects on Non-energy Characteristics
Mount compressors and condensers on top of unit			-
Plastic liners§			
IMPROVEMENTS IN EXISTING TECHNOLOGY			
Improved refrigerants	30	$240	
Evacuated panels§			
Bottom-mounted compressor			
"Smart" defrosting cycles§			
Improved insulation materials and gaskets			
Heat recovery systems for the condenser			

§ Already in use in some mass-produced European or Japanese models.

* Total capacity of 15.5 to 17.9 cu. ft.(410 to 550 litres), top freezer, frost free model.

FIGURE 4.1 : REFRIGERATORS/FREEZERS



4.1.3 **Freezers:** A freezer is essentially an insulated box with a refrigeration system designed to keep the temperature at about -18°C. Energy use in freezers is compared with both size and freezing capacity (the time required to lower the temperature of food to below freezing). Because cold air is heavy, chest freezers are inherently more efficient than uprights, from which cold air tends to tumble out with each opening of the door. Manual defrost systems are adequate for many freezers inasmuch as moisture accumulation is limited since the door is opened only a few times per day. About 70% of the electricity used in the freezer is accounted for by the compressor with 20% from heating elements and 10% from the fan. Heat gain is mainly through the walls and the door gaskets, with food itself and door openings being relatively minor contributors.

Improved efficiency with freezers can come both from reductions in heat losses and improvements in the efficiency of the motor-compressor and fan systems. For models that contain a defrost cycle, a variety of measures are available to reduce energy use, though they will always use more energy than manual defrost models. Most options for improving freezer efficiency depend on extensions of existing technology; no truly radical options are even on the horizon, except perhaps those that depend on "passive assist" through extending cooling coils to surfaces outside the house.

TABLE 4.2: CHEST FREEZERS
EXISTING SITUATION AND POTENTIAL
FOR IMPROVEMENT IN ENERGY EFFICIENCY

CANADIAN BASE

	Size A	Size B
	10.0 to 14.0 ft^3	14.1 to 17.9 ft^3
	283 l to 396 l	399 l to 509 l
Range of models available (1986):	44 to 77 kWh/m	51 to 115 kWh/m
Range of models available (1981):	57 to 94 kWh/m	59 to 117 kWh/m

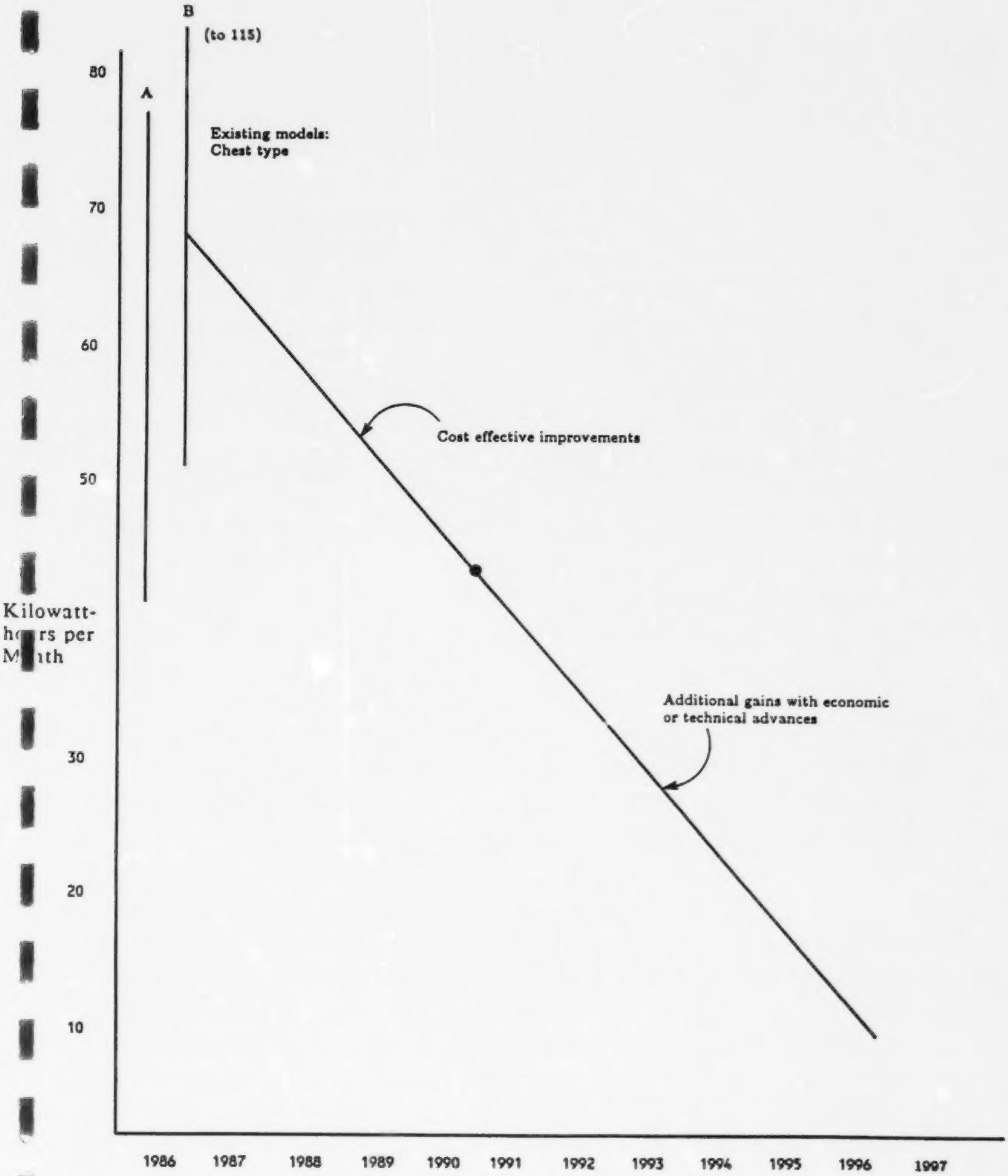
OPTIONS FOR IMPROVEMENT

Category and Measure	Percentage Savings for Typical Units (non-additive)	Manufacturing Costs ($/unit)	Effects on Non-energy Characteristics
COST EFFECTIVE NOW			
Increase insulation to 8 to 9 cm	15 to 35 } 50	$25	+
More efficient motor, compressor and fan	10 to 25 }		+
Better door gaskets or double gasket			
EXISTING TECHNOLOGY WITH COST REDUCTIONS			
Thermal contact of tubing	3 to 5		
Improved air distribution system§	} 20 to 30	$100	
Increase heat exchanger surface area§	}		
Shift to foam insulation§	}		
Anti-sweat heater switch	}		

Category and Measure	Percentage Savings for Typical Units (non-additive)	Manufacturing Costs ($/unit)	Effects on Non-energy Characteristics
IMPROVEMENTS IN EXISTING TECHNOLOGY			
New refrigerants	10	$200	
Evacuated panels§			
Fluid control valves for refrigerant	40 to 50		
Improved foams§			

§ Already in use on some mass-produced Japanese and European models.

FIGURE 4.2 : CHEST FREEZERS



Possible Year of Introduction of More Efficient Models

4.1.4 **Kitchen Ranges:** A kitchen range of some kind is found in every home--indeed, it almost defines a home--with every fuel imaginable being used in some location. In Canada, by far the predominant energy source is electricity, though on the Prairies gas stoves are a strong second. Although smaller units are found in apartments, the most common kitchen range today consists of four direct heating elements on a surface and an oven heated by separate elements; the two parts of the range may be combined into one appliance or, in built-in designs, they may be separate. Whatever the design, in typical households the surface elements and the oven consume roughly equal amounts of energy over the course of a month, and the Energuide ratings show a combined total energy use. (Energuide ratings ignore any special features, such as microwave units.) Energy use by a kitchen range is generally below that for lighting, refrigeration and hot-water consuming appliances, but it is of particular concern to utilities because it tends to occur at peak periods.

There is a widespread misconception that no energy savings are possible with a kitchen range. However, given that only about 15% of the energy input to the range ends up heating food, the potential is significant. As indicated by the table, simple changes could save about a fifth of current energy use and more complex changes another third. (The very fact that self-cleaning ovens have Energuide ratings comparable to regular ovens indicates that higher levels of insulation are entirely practical.) These changes are independent of any savings achieved through use of microwave cooking, which is more appropriate treated as an added feature or additional appliance rather than an alternative to the oven. They are also independent quasi-behavioural changes, such as matching the pot to the burner; use of small appliances, such as coffee makers, which take half as much energy as a surface element; and purchase of insulated cooking vessels. As indicated by the narrow range for Energuide ratings, less research has gone into studying the range as opposed to other large appliances.

Table 4.3: KITCHEN RANGES: EXISTING SITUATION AND POTENTIAL FOR IMPROVEMENT IN ENERGY EFFICIENCY

CANADIAN BASE*

Range of available models (1986):	63 to 71 kWh/m
Range of available models (1981):	64 to 71 kWh/m

OPTIONS FOR IMPROVEMENTS

Category and Measure	Percentage Savings for Typical Units (non-additive)		Manufacturing Costs ($/unit)	Effects on Non-energy Characteristics
EXISTING TECHNOLOGY WITH COST REDUCTIONS**				
Oven				
Improved door seals	5 to 11	7 to 25	$45	
Improved door design	3 to 5			
Reduce vent area	3			
Higher density insulation	7 to 10			
Super-insulation	50 to 80			- ***
Surface Elements				
Reflective pans	1	5 to 10	$5	
Greater surface area	3			
Reduced thermal mass	2 to 5			
Reduced contact resistance	2 to 9			
Solid hob (flatter) element	1 to 5			
IMPROVEMENTS IN EXISTING TECHNOLOGY				
Oven				
Reflective interior	17			
Reduce thermal mass	3 to 8			
Bi-radiant ovens	50 to 65		$40	+
Forced air convection	40			-

Category and Measure	Percentage Savings for Typical Units (non-additive)	Manufacturing Costs ($/unit)	Effects on Non-energy Characteristics
Surface Elements			
Anti-convection elements	7	$40	
Automatic controller	20 to 45		
Very low thermal mass	10 to 15		
Induction Cooktops §	20 to 40	$100+	+
USE OF NEW TECHNOLOGY			
Oven			
Small oven insert (10 to 25 L)	60		
Surface Elements			
Ceramic cooktops with halogen (infrared) lights			

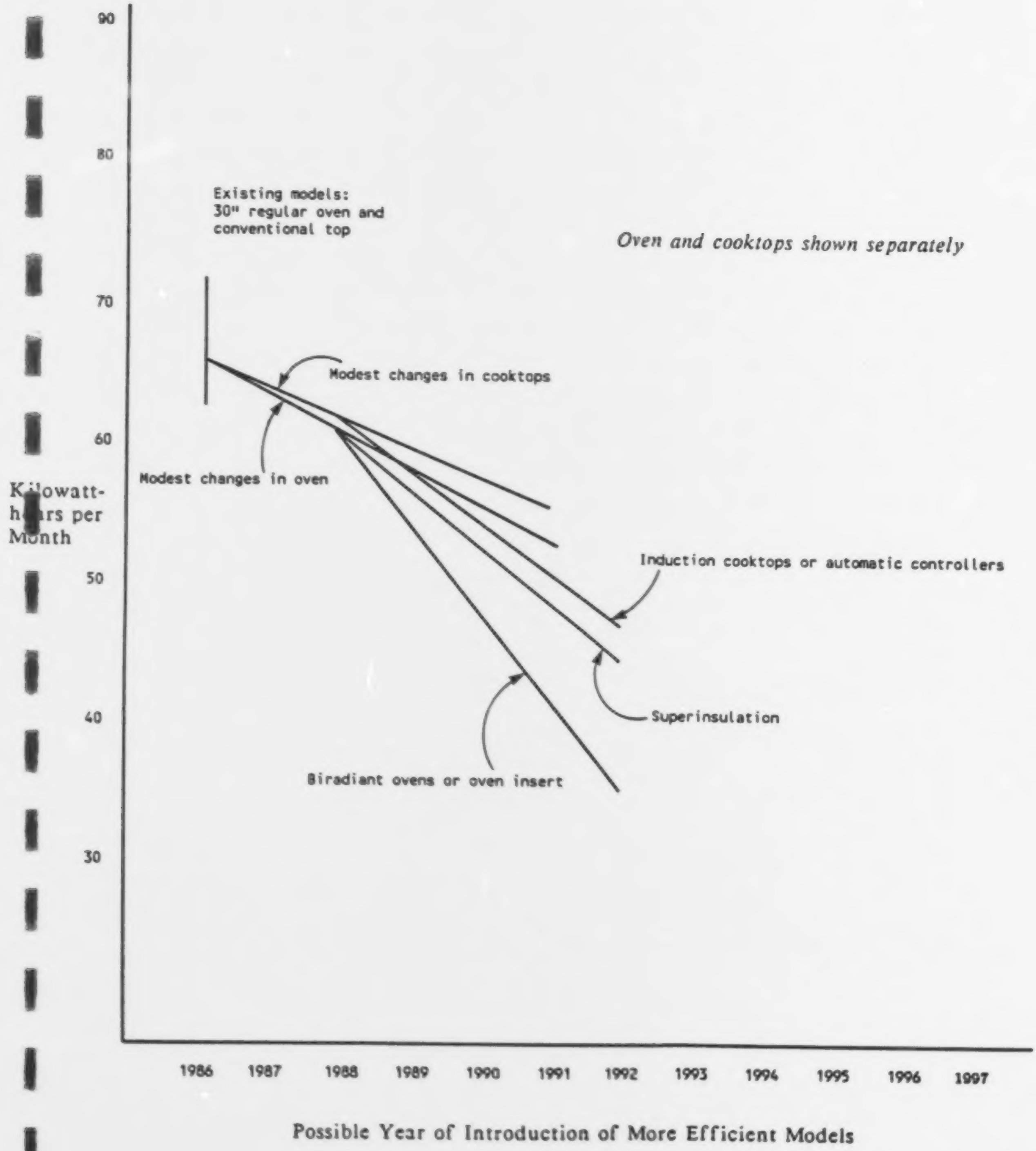
§ Already in use on some mass-produced Japanese and European models.

* Width of 30 inches, regular oven and conventional top

** Reports vary as to whether costs are a little above or a little below 5¢/kWh.

*** If oven size is reduced.

FIGURE 4.3 : KITCHEN RANGES



4.1.5 **Dishwashers:** Electric dishwashers operate by directing streams of hot (typically 60°C) water against dirty dishes to dislodge food particles and to wash and sterilize them. Most models will also dry dishes with a stream of hot air, but generally there is a switch to override this option. Over 80% of the energy required by electric dishwashers is for the hot water, with motors and pumps taking the remainder. Typical household models use 25 to 45 litres of hot water per cycle.

There is no theoretical minimum amount of energy necessary to clean dishes, and to date improvements have focussed on ways to reduce the volume of hot water required. Further improvements are possible by a variety of techniques that serve to conserve the temperature or that make more efficient use of the hot water. Some options have been proposed that would use lower temperature water. Reports of results are mixed, but a jet spray device that would use both less and cooler water than conventional systems is under development. European models commonly heat water at the point of use, but this approach is not common in North America. A more radical approach would depend on ultrasonic vibrations to remove food particles.

TABLE 4.4: ELECTRIC DISHWASHERS: EXISTING SITUATION AND POTENTIAL FOR IMPROVEMENT IN ENERGY EFFICIENCY

CANADIAN BASE*

Range of available models (1986):	83 to 110 kWh
Range of available models (1981):	86 to 98 kWh

OPTIONS FOR IMPROVEMENT

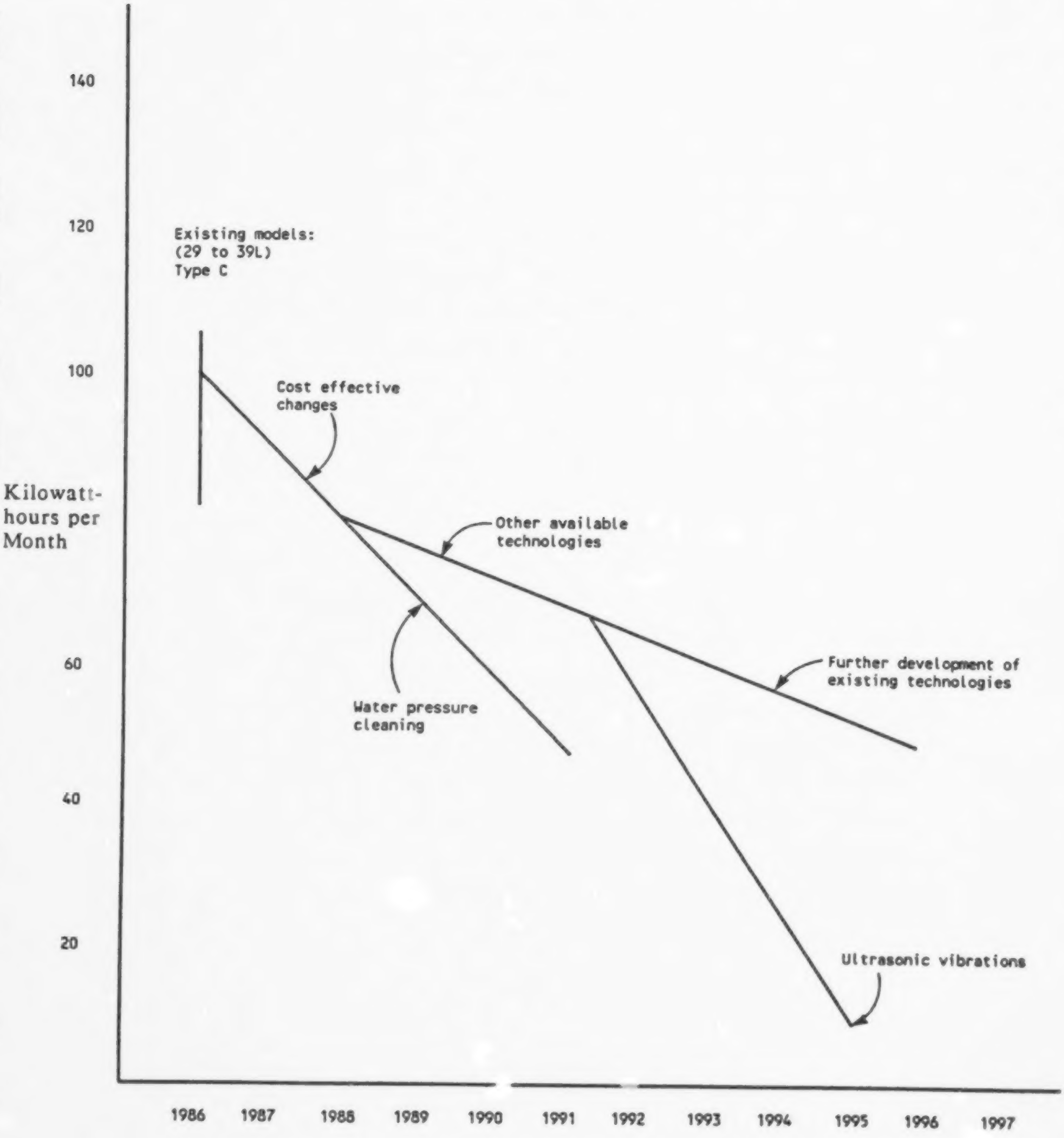
Category and Measure	Percentage Savings for Typical Units (non-additive)		Manufacturing Costs ($/unit)	Effects on Non-energy Characteristics
COST EFFECTIVE NOW				
Air Drying**	8		$1	-
Three instead of four rinses**	15		nil	?
EXISTING TECHNOLOGY WITH COST REDUCTION				
Improved fill control	7	15	$50 to $100	
Improved motors and pumps	3			
Added insulation	3 to 10			
Improved food filters	10			
IMPROVEMENTS IN EXISTING TECHNOLOGY				
Improved food filters	10-15			+
Improved spray arm design and timing	10-15			
Low temperature detergents (120^{o}F/50^{o}C)*	18			?
Internal water heating				
Improved tub design	15			

Category and Measure	Percentage Savings for Typical Units (non-additive)	Manufacturing Costs ($/unit)	Effects on Non-energy Characteristics
USE OF NEW TECHNOLOGY			
Water pressure cleaning	50		
Ultrasonic Vibrations	80		

* Water use of 29 to 39 L.

** Includes behavioural component.

FIGURE 4.4: DISHWASHERS



Possible Year of Introduction of More Efficient Models

4.1.6 **Electric Clothes Washers:** Electric clothes washers use a combination of mechanical and chemical action to free dirt from clothes, plus soaking in clear water to rinse clothes and a spinning motion to dry them. Typical household models have tub sizes that range from 45 to 75 litres and switches that permit the user to select among a number of wash and rinse cycles. Depending upon the selection, between 80% and 90% of the energy requirements stem from the use of hot water, with motors and pumps accounting for the remainder. Taken together, clothes washers and dishwashers account for about half the hot water use in houses where both are present. Few if any new models today include a hot rinse cycle, and all have a cold rinse option (which has been shown to be fully effective). There are two common types of clothes washers: top loading and front loading; the former are much more common in North America but the latter require about one-third less energy per cycle.

A variety of electronic controls, improvements in tub geometry and better insulation are possible to reduce the volume or conserve the heat of the water used by the clothes washer. Other options would improve the efficiency of motors and pumps. European models commonly heat water at the point of use but this approach is not common in North America. With appropriate detergents, cold water washing is possible for all but the dirtiest clothes. More radical measures involve cycles that separate the mechanical from the chemical parts of the cleaning cycles, that dislodge dirt by ultrasonic vibration, or that use electrolytic means (rather than heat) to stimulate the bleaching and cleaning action.

TABLE 4.5: CLOTHES WASHERS: EXISTING SITUATION AND POTENTIAL FOR IMPROVEMENT IN ENERGY EFFICIENCY

CANADIAN BASE*

Range of available models (1986):	50 to 160 kWh/m
Range of available models (1981):	61 to 160 kWh/m

OPTIONS FOR IMPROVEMENT

Category and Measure	Percentage Savings for Typical Units (non-additive)	Manufacturing Costs ($/unit)	Effects on Non-energy Characteristics
COST EFFECTIVE NOW			
Cold Water rinse**	10 to 25	nil	+
Use of Suds saver models**	10 to 12		
Warm water wash**	15 to 25	nil	+
EXISTING TECHNOLOGY WITH COST SAVINGS			
Front loading models§	33 to 40		-
Improved motors and pumps	3		
Add insulation	2 to 5		
Reduction of thermal mass of tub	2		
Automatic fill control**	variable		
Thermostatic water valves	2		
IMPROVEMENTS IN EXISTING TECHNOLOGY			
Lower temperature detergents	10 to 20		
Separation of mechanical and chemical cleaning	33		+
Redesign of tub	5 to 20	nil	
Internal water heating	?		

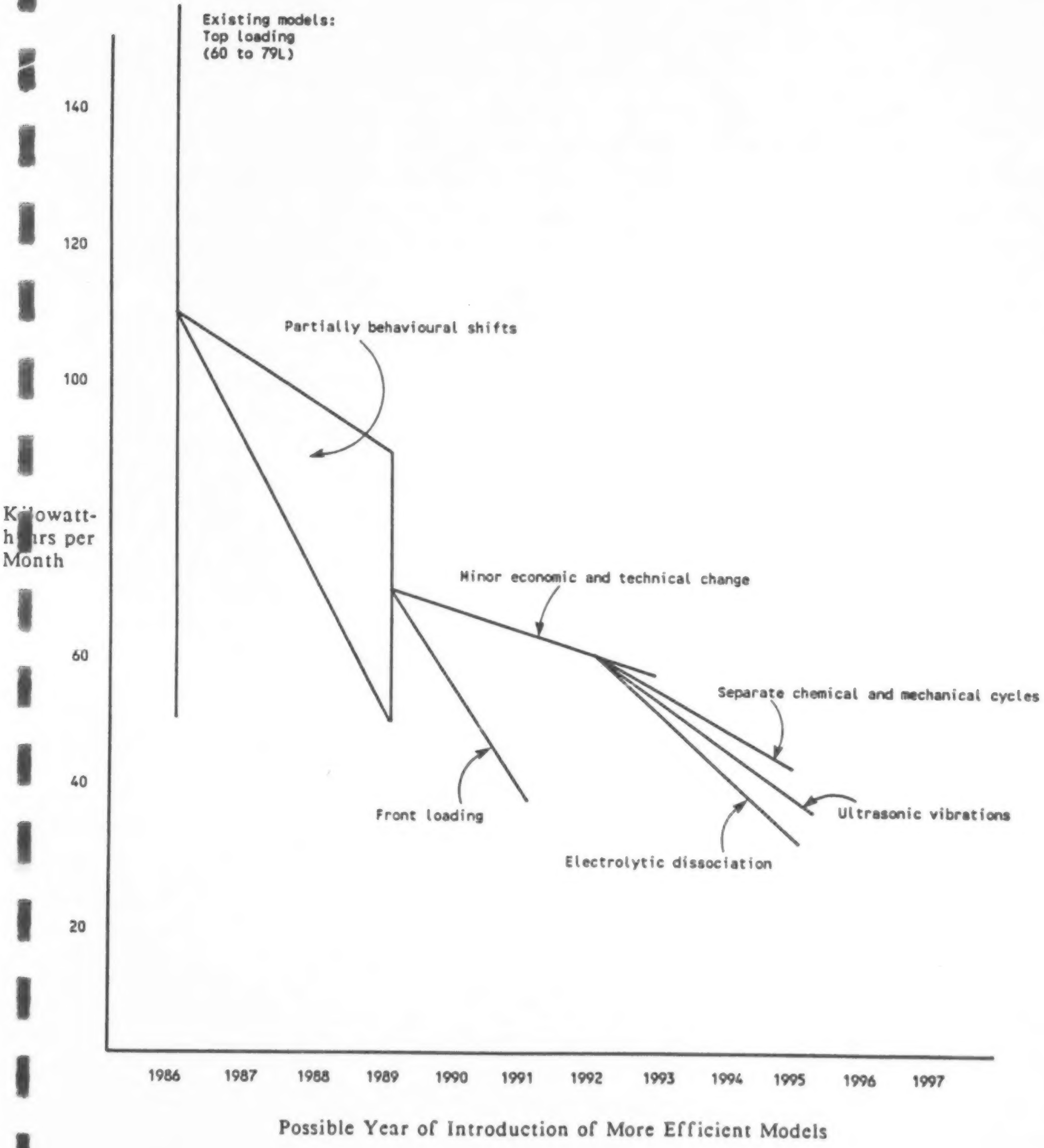
Category and Measure	Percentage Savings for Typical Units (non-additive)	Manufacturing Costs ($/unit)	Effects on Non-energy Characteristics
USE OF NEW TECHNOLOGY			
Electrolytic dissociation	50 to 60		
Ultrasonic vibration	50		+
Water driven, non-electric			-

* Size of 60 to 79 L.

** Includes behavioural component.

§ Already in use in some mass-produced Japanese and European models.

FIGURE 4.5 : CLOTHES WASHERS



4.1.7 **Electric Clothes Dryers:** Conventional electric clothes dryers work by revolving clothes in a stream of hot air that serves to evaporate the water left after the spin dry cycle in the clothes washer. Typical household models have drum capacities of 130 to 180 litres. Clothes dryers represent a major electrical end-use for those homes that have them, but, because they consume two to three times as much energy to dry clothes as is theoretically required, there is considerable scope for efficiency gains. The most recent change in the market is to control the drying process not by time, as with most machines today, but by moisture content. In addition to conventional drying, clothes can be dried by use of a heat pump (which has a particular advantage in apartments in being able to operate on 110 volt power and replacing the vent with a drain pipe) and by microwave heating (which offers time as well as energy savings). Prototype models have been built. In addition, exhaust heat recovery is practiced in other countries and could be used to heat input air or to supplement indoor heating. As with kitchen ranges, the perception that there is little opportunity for energy savings has limited the amount of research on improving clothes dryers.

TABLE 4.6: ELECTRIC CLOTHES DRYERS: EXISTING SITUATION AND POTENTIAL FOR IMPROVEMENT IN ENERGY EFFICIENCY

CANADIAN BASE*

Range of available models (1986):	89 to 111 kWh/m
Range of available models (1982):	89 to 94 kWh/m

OPTIONS FOR IMPROVEMENT

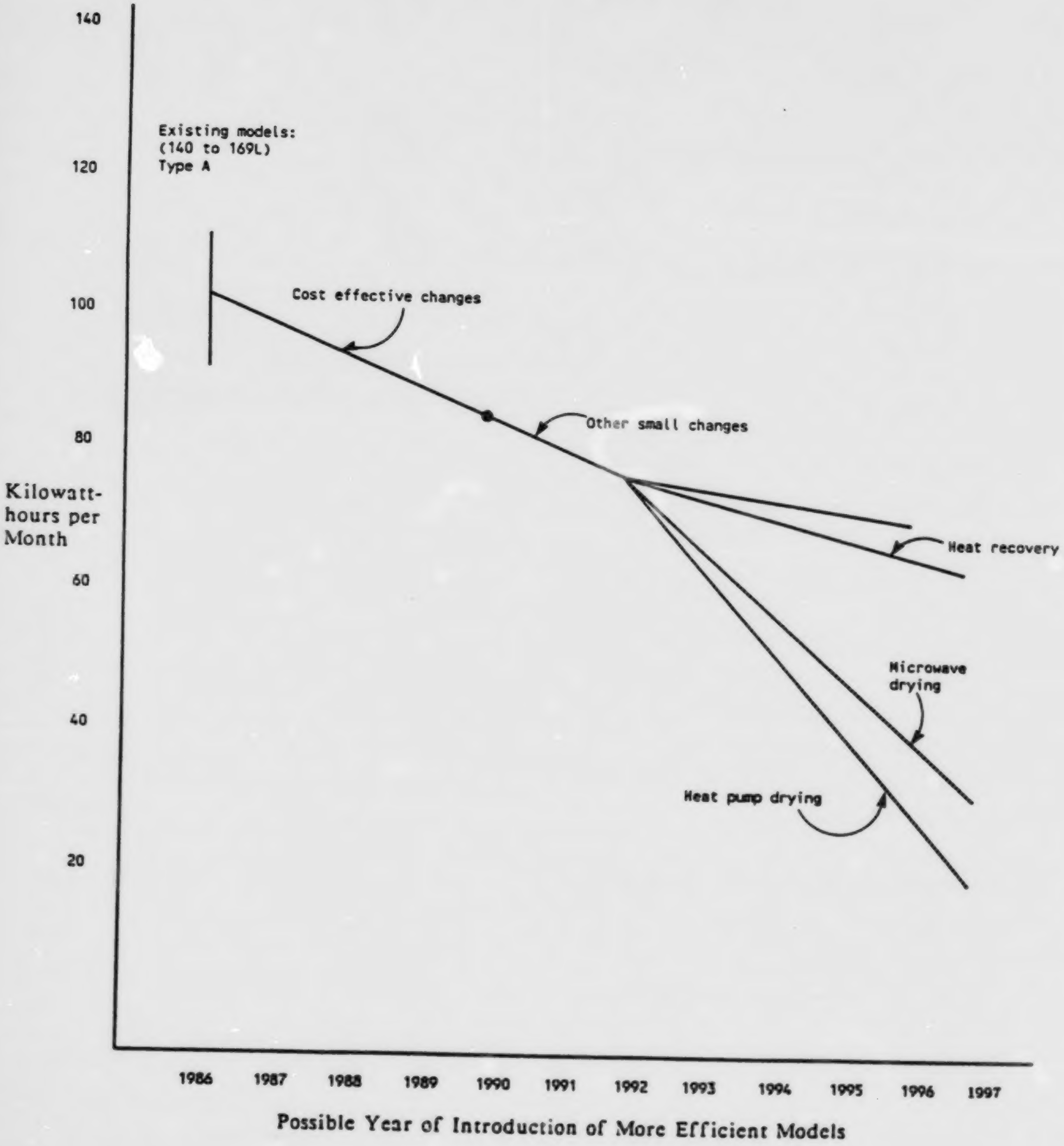
Category and Measure	Percentage Savings for Typical Units (non-additive)	Manufacturing Costs ($/unit)	Effects on Non-energy Characteristics
COST EFFECTIVE NOW			
Electronic Humidity Sensors	10 to 15	$40	+
Improved motors and pumps	2	$10	
Lower drying temperature	10	nil	-
COST REDUCTIONS WITH EXISTING TECHNOLOGY			
Add insulation Improve door seals Reduce thermal mass of drum	6	$50	
Exhaust Heat Recovery§	15	$135**	?
IMPROVEMENTS IN EXISTING TECHNOLOGY			
Redesign of Dryer Chamber	2	nil	
USE OF NEW TECHNOLOGY (mid-1990s)			
Heat Pump Drying	55 to 70	$265	+
Microwave Drying	50	$160	+

§ Already in use on some mass-produced Japanese and European models

* 140 to 169 L size (see Attachment B).

** Includes added installation costs.

FIGURE 4.6 : ELECTRIC CLOTHES DRYERS



4.2 Heating and Cooling Equipment

4.2.1 **Introduction:** This section covers all heating and cooling equipment designed to completely heat or cool residential homes, plus room air conditioners. It does not cover residential unit, "wall", or portable heaters or water heaters. Water heaters are treated separately in the next section.

The review describes the most recent advances in heating and cooling technologies and those currently under development. An indication of the expected efficiencies of new generations of heating and cooling equipment using these technologies is given, plus an estimate of the cost premium that is currently found for market ready and near market ready technologies.

4.2.2 **Classification:** Space heating and cooling equipment may be most conventionally classified by fuel and by the method of heat distribution. There are fundamental differences between the technologies used with each fuel, and between furnace (air) and boiler (water) technologies. There are also generic differences between the efficiencies of equipment using each fuel and each method of distribution that are independent of the technology being used. The most important of these are:

- Oil combustion is generally more efficient than gas combustion because of the lower hydrogen to carbon ratio in oil. Combustion is more complete and less water vapour is produced.

- Furnaces are generally more efficient than boilers because return air is at a lower temperature than return water, therefore improving the rate of heat transfer.

Table 4.7: Categories of Space Heating and Cooling Equipment lists the major space heating equipment categories addressed in this review. Only heating equipment designed to condition the total space in a residential building is included, plus room air conditioners.

TABLE 4.7
CATEGORIES OF SPACE HEATING AND COOLING EQUIPMENT

FUEL	DISTRIBUTION MEDIUM	
	AIR	WATER
OIL	OIL FURNACES	OIL BOILERS
GAS	GAS FURNACES	GAS BOILERS
ELECTRICITY	ELECTRIC FURNACES HEAT PUMPS CENTRAL AIR CONDITIONERS ROOM AIR CONDITIONERS	ELECTRIC BOILERS

Baseboard, wall, and portable heaters are not considered. Heat pump technology is included in the electric/air distribution category.

4.2.3 **Assessment of Efficiency:** There are two standard methods of assessing the efficiency of space heating and cooling equipment:

1. Steady-State Efficiency - A measure of heating or cooling output relative to energy input while the equipment is running continuously under a set of standard operating conditions.

2. Seasonal or Annual Efficiency - A measure of the expected average heating and cooling output over a season or a one year period under real operating conditions relative to the amount of energy used.

The differences between the two measures of efficiency are due to the following:

- Under real operating conditions heating or cooling equipment is started and stopped as required to meet the heating or cooling load. Oil and gas combustion technologies and heat pump/air conditioning equipment operate less efficiently when starting up than at a steady state.

- Conventional oil and gas burners require to be protected from outside pressure fluctuations. Barometric dampers (oil) and draft dilution devices (gas) are used to provide this protection, but at the expense of losing heated house air.

- Where any oil or gas heating equipment is not operating, heated house air is lost due to the stack effect.

- The efficiency of a heat pump is very dependent on the source of heat used. The lower the source temperature, the lower the efficiency. The efficiency of air source heat pumps is therefore reduced by low winter temperatures. Air conditioning equipment efficiency is similarly affected by high outside temperatures.

Steady state efficiency is normally measured according to a testing protocol given in the following performance standards for each category of heating and cooling equipment:

Oil Furnaces	CSA B140.4-1974
Oil Boilers	CSA B140.7.1-1976
Gas Furnaces	CGA-2.3-M86
Gas Boilers	CGA-4.9-1969
Electric Heat Pumps	CSA C273.3-M1977
Electric Furnaces	Not Applicable*
Central Air Conditioners	CSA C27.3-M1977
Room Air Conditioners	CSA C368.1-M1980

* Electric resistance heating furnaces are assumed to be 100% efficient on a steady state and seasonal basis.

The above standards are mandated by most electrical and gas utilities and widely used as a measure of efficiency of heating and cooling equipment. In gas and oil equipment, the efficiency is expressed as Percent Combustion Efficiency = 100 times Useful Heat Energy/Fuel Energy Consumed. In heat pump and air conditioning equipment, the efficiency is expressed as Coefficient of Performance (COP) = Useful Heating or Cooling Energy/Electrical Energy Consumed.

The assessment of seasonal or annual efficiency is most commonly carried out by developing a special test protocol which substitutes a "surrogate" test protocol for testing under real conditions. The surrogate test attempts to simulate average conditions as far as possible but over a short test period.

Table 4.8: Seasonal and Annual Efficiency Test Protocols lists the performance standards developed to estimate annual or seasonal performance of heating and cooling equipment in Canada and the United States. Note that seasonal efficiency as a concept does not lend itself to room air conditioners.

TABLE 4.8
SEASONAL AND ANNUAL EFFICIENCY TEST PROTOCOLS

	CANADA	UNITED STATES
Gas Furnaces	CGA-CAN1-P.1-85 Seasonal Gas Utilization Efficiencies (SGUE) of Gas Fired Furnaces	Department of Energy Uniform Method of Measuring the Energy Consumption (Annual Fuel Utilization Efficiency (AFUE)) of Furnaces and Boilers
Gas Boilers	None	AFUE
Oil Furnaces	None	AFUE
Oil Boilers	None	AFUE
Electric Heat Pumps	None	Air Conditioning and Refrigeration Institute Standard 240-81 Heating Seasonal Performance Factor (HSPF)*
Central Air Conditioners	None	Air Conditioning and Refrigeration Institute Standard 210-81 Seasonal Energy Efficiency Ratio (SEER)**

* Heating Performance Factor = 3.41 times Coefficient of Performance (COP)

** Energy Efficiency Ratio = 3.41 times Coefficient of Performance (COP)

Seasonal efficiencies are not currently used in Canada. In the United States, however, annual directories of certified products with their SEER and HSPF ratings are published by the Gas Appliance Manufacturers Association (GAMA) and the Air Conditioning and Refrigeration Institute respectively for gas and oil furnaces and boilers, and heat pumps and central air conditioners.

4.2.4 Space Heating and Cooling Technologies: Space heating and cooling technologies have seen several significant changes over the past ten years which have greatly increased their efficiencies. Gas heating advances have included electronic ignition, induced draft and pulse burners, and condensing heat exchangers. Oil heating advances have included retention head burners and improved heat exchangers. Heat pump and air conditioner advances have included more efficient compressors and better controls.

In this review a "conventional" heating and cooling technology is defined as a naturally aspirated oil or gas furnace or boiler and a standard heat pump or air conditioner that were available prior to 1975. Advances have been classified into low efficiency, mid-efficiency and high efficiency groups as follows:

	Seasonal Efficiency Gas/Oil Equipment	HSPF* (Heat Pump) and SEER* (Air Conditioners)
Conventional	<60%	<7.0
Low Efficiency	60-75%	7.0-8.5
Mid Efficiency	75-90%	8.5-10.0
High Efficiency	90-100%	>10.0

* Under United States Standard Conditions

Tables 4.9, 4.10, 4.11 and 4.12 summarize the innovations in oil, gas, and electric heating and cooling equipment technology that have occurred over the past 10 years, along with those which are currently under development and promise to penetrate the market in the near future. Average steady-state and seasonal efficiencies are given for each technology, along with an indication of the technology's state of development and an estimate of the cost premium over conventional technologies.

The major conclusions to be drawn from the information provided in these tables are:

- state-of-the art efficiencies for direct combustion heating equipment in North America are close to the maximum.
- there are future technical improvements possible in electric and gas heat pumps, air conditioners and evaporative cooling.

However, it is important to note that while there are high-efficiency, state-of-the-art models available in furnaces and other types of equipment, the conventional, low-efficiency models are still on the market and constitute the bulk of sales. There is, therefore, large scope for market share improvement for high efficiency models. There appears also to be some scope for cost reductions in the high-efficiency models. Furthermore, in the area of cooling equipment and heat pumps it is doubtful whether the state-of-the-art equipment is even available in Canada due to low air-conditioning loads and low electricity rates.

TABLE 4.9
OIL FURNACE AND BOILER* TECHNOLOGIES

Technology	Effect on Performance	Steady State Efficiency	Seasonal Efficiency	State of Development	Cost Premium
Conventional	-----	70-75%	60%	-----	-----
Reduced Firing Rate	. Reduces Off-cycle Period	70-75%	65-70%	Market Ready	$0
Chimney Damper	. Reduces Off-cycle Chimney Losses	70-75%	62-68%	Market Ready	$100-$200
Retention Head Burner	. Reduces Excess Air . Reduces Off-Cycle Chimney Losses	78-84%	67-75%	Market Ready	$0-$100
Induced Draft Burner	. Eliminates Dilution Air . Eliminates Off-Cycle Losses	75-90%	75-90%	Under Development Available in Europe	?
Condensing Heat Exchanger with Induced Draft Burner	. Recovers Latent Heat	90-96%	85-95%	Under Development Available in Europe	?

* Boiler Efficiencies are on average 2-5% lower than Furnace Efficiencies for each technology because of the higher return water temperature.

TABLE 4.10
GAS FURNACE AND BOILER* TECHNOLOGIES

Technology	Effect on Performance	Steady State Efficiency	Seasonal Efficiency	State of Development	Cost Premium
Conventional	-----	75%	60-65%	-----	-----
Electrical Intermittant Ignition Device (IID)	. Eliminates Pilot Losses	75%	66-69%	Market Ready	< $100
Stack Damper & IID	. Reduces Off-cycle Chimney Losses	75%	70-72%	Market Ready	$100-$200
Improved Heat Exchanger & IID	. Lowers Flue Gas Temperature	75-80%	75-79%	Market Ready	< $100
Induced Draft Burner & IID	. Eliminates Dilution Air . Eliminates Off-cycle Losses	81-87%	81-87%	Market Ready	$800-$1000
Condensing Heat Exchanger (with Induced Draft or Pulsed Burner & IID)	. Recovers Latent Heat	92-99%	91-97%	Market Ready	$1000-$1500

* Boiler Efficiencies are on average 2-5% lower than Furnace Efficiencies for each technology because of the higher return water temperature.

TABLE 4.11
ELECTRIC FURNACE, BOILER AND HEAT PUMP TECHNOLOGIES

Technology	Effect on Performance	COP at -8°C	HSPF	State of Development	Cost Premium
Furnaces/Boilers					
Conventional	-----	1.0	3.4	-----	-----
Heat Pumps					
Conventional	-----	1.8*	6.0*	-----	-----
Two Speed Compressor Efficient Motors Efficient Fan Improved Condenser/ Evaporator Design	. Reduced Losses . Equipment Downsizing . Better Output/Load Matching . Improved Heat Transfer	2.0-3.0*	7.0-10.0*	Market Ready	$230-$420 per unit increase in HSPF
Variable Speed Compressor & Motor, Fan, & Heat Transfer Improvements	. As Above	+10%	+10%	Under Development Available in Japan	?
As Above & Demand Defrost	. Improved Heat Transfer	+10%	+10%	Under Development	?
As Above & Electronic Expansion Valve	. Shorter Defrost . Improved Control	+10%	+10%	Under Development	?
As Above & Non-Azeotropic Refrigerants	. Improved Vapour Compression Efficiency	+10%	+10%	Under Development	?

* Typical ARI (US) Test Values

TABLE 4.12
ELECTRIC AIR CONDITIONING TECHNOLOGIES

Technology	Effect on Performance	EER (Room)	SEER (Central)	State of Development	Cost Premium
Conventional	-----	6.0-7.0*	7.0-8.0*	-----	-----
Two Speed Compressors Efficient Motors Efficient Fans Improved Condenser/ Evaporator Design	. Reduces Losses . Equipment Downsizing . Better Output/Load Matching . Improved Heat Transfer	7.0-12.0	8.0-15.0*	Market Ready	$230-$420 per unit increase in SEER
Variable Speed Compressor & Motor, Fan & Heat Transfer Improvements	. As Above	+10%	+10%	Market Ready Offshore	?
As Above & Electronic Expansion Valves	. Improved Control	+10%	+10%	Under Development	?
As Above & Non-Azeotropic Refrigerants	. Improved Vapour Compression Efficiency	+10%	+10%	Under Development	?
Evaporative Cooling	. More Efficient than Vapour Compression Cycle	-----	>30%	Under Development	?

* Typical ARI (US) Test Values

4.3 Water Heating Equipment

4.3.1 **Introduction:** This review covers gas, oil, and electric storage type residential water heaters. It does not include point-of-use or instantaneous units.

Recent advances in technology are described for each fuel type and estimates of the expected improvement in energy factor are given. Estimates of cost premiums are provided for market ready technologies.

4.3.2 **Classification:** The most convenient way to classify water heaters is by fuel type or fuel type combination as follows:

- Oil
- Gas
- Electric
- Electric/Solar Combination
- Electric Heat Pump

It is assumed that for residential applications where a water heater must provide all home hot water requirements, an instantaneous water heater would put too high a power demand on the electrical or gas system.

Each of the above water heater types employ basically different technologies and new developments are unique to different types.

4.3.3 **Assessment of Performance:** The efficiency of a water heater must be assessed in terms of how well fuel energy is converted to hot water and how well heat is conserved in a standby mode once heated. In storage type water heaters, the unit must also be able to "recover" at a sufficiently high rate to meet the daily hot water requirements of a normal household. There are currently two approaches to the standard assessment of water heater efficiency:

- Determine whether conversion efficiency, stand-by loss, and recovery rate under standard conditions meet certain required levels without recording the actual values.

- Measure the standby loss and recovery efficiency under standard conditions and calculate an "energy factor" based on these measurements.

The first approach is used in Canada and the methods of assessment appear in the following standards:

Electric Storage Type	CSA C191-M1983
Gas Storage Type	CGA CAN-4.1-M85
Oil	CSA B140.3-1980
Solar/Electric Storage Type	CSA F379.1-M1985
Electric Heat Pump Storage Type	None

The second approach is used in the United States where the energy factor (EF) is defined as:

$$EF = H_W E_R/(H_W + S + E_R P)$$

Where H_W = Daily Hot Water Energy Requirement
E_R = Recovery Efficiency
S = Standby Loss per Day
P = Pilot Loss per Day

The energy factor approach can be used to assess the difference in effectiveness and efficiency between different technologies for the same fuel and between different fuels. Note that for water heaters without pilots, $P=0$, and for instantaneous water heaters, $S=0$. The Recovery Efficiency E_R is the fraction of the heat input that is used for heating. In an instantaneous heater it is equal to the conversion efficiency. In a storage type heater, it is related to the conversion efficiency; the size of the element, burner, solar collector or heat pump; and the standby loss. The Standby Loss S is equal to the sum of losses through the wall of the storage tank plus any convection losses in piping, etc.

4.3.4 **Improvements in Water Heating Technologies:** Tables 4.13, 4.14 and 4.15 show innovations in Gas, Oil and Electric water heating technology that have occurred over the last 10 years or are currently under development. In each case, an estimate of the energy factor is given along with an indication of the state of development, and an estimate of the cost premium over conventional water heaters.

Conventional water heaters in this review are defined as storage type heaters with twin electric heating elements or a central flue oil/gas burner with barometric damper (oil) or draft diverter (gas). Conventional gas water heaters are assumed to use pilot combustion with no electrical connection. Not included in this review are very minor improvements such as the introduction of thermal breaks in storage tank legs, improvements that depend on water using equipment (e.g., low flow shower heads or high pressure dishwashers), or the recovery of heat from de-superheaters on air conditioning equipment.

The major conclusions to be drawn from the information provided in these tables are:

- While direct fired oil/gas water heaters employ technologies similar to oil/gas space heating, the development of high-efficiency models is lagging far behind.

- There is large potential for technical efficiency improvements in water heaters of all types.

- The lack of published performance results for water heaters in Canada makes comparison difficult and is likely stifling efficiency improvements.

- Outside air source heat pump water heaters will not be cost effective in Canada, but ventilation air source heat pump and solar/electric or solar/gas water heaters have some potential.

TABLE 4.13
GAS WATER HEATER TECHNOLOGIES

Technology	Effect on Performance	Energy Factor	State of Development	Cost Premium
Conventional	-----	40-55%	-----	-----
Jacket Insulation, Thermal Traps and Better Baffling	. Reduces Standby Loss	60-65%	Market Ready	$40-$60
Electronic Intermittent Ignition Devices (IDD) Plus Vent Damper	. Eliminates Pilot Loss . Reduces Off-cycle Chimney* Losses	65-70%	Developed but not marketed	$150 - $200
Induced Draft Burner Plus Flue Baffling or Multiple Flues	. Eliminates Excess Air . Improves Heat Exchange . Eliminates Off-cycle Losses	70-80%	Under Development	?
External Combustion	. Reduces Off-cycle Losses	75-80%	Under Development	?
Condensing Heat Exchanger	. Recovers Latent Heat	80-85%	Market Ready	$500

* Losses through draft diverter to inside of house are still significant.

TABLE 4.14
OIL WATER HEATING TECHNOLOGIES

Technology	Effect on Performance	Energy Factor	State of Development	Cost Premium
Conventional	-----	50-60%	-----	-----
Jacket Insulation & Thermal Traps	. Reduces Standby Losses	60-65%	Market Ready	$40-$60
Vent Damper	. Reduces Off-cycle Chimney Losses	65-70%	Under Development	?
Induced Draft Burner Plus Flue Baffling or Multiple Flues	. Eliminates Excess Air . Improves Heat Exchange . Eliminates Off-cycle Chimney Losses	75-80%	Under Development	?

TABLE 4.15
ELECTRIC WATER HEATING TECHNOLOGIES

Technology	Effect on Performance	Energy Factor	State of Development	Cost Premium
Conventional	-----	75-80%	-----	-----
Jacket Insulation & Thermal Traps	. Reduces Standby Losses	90-95%	Market Ready	$40-$60
Heat Pump Water Heater (HPWH)	. Recovers Excess House Heat	1.0-2.0*	Market Ready	$1000-$1500
HPWH with Variable or Two Speed Compressor with Improved Evaporator/ Condensor	. Recovers Excess House . Matches Output to Load . Improves Heat Transfer	2.0-2.5*	Under Development	?
HPWH (Exhaust Heat Recovery)	. Recovers Heat from Ventilation Air	1.5-2.0	Market Ready	$1000-$1500
Solar/Electric Water Heater	. Reduces Electricity Demand	2.0-3.0	Market Ready	$1500-$2000

* The Energy Factor of a Heat Pump Water Heater that is designed to extract heat from within the house only achieves an effective energy factor greater than a conventional electric water heater when there is excess house heat from ambient sources.

5.0 U.S. NATIONAL APPLIANCE ENERGY CONSERVATION ACT OF 1987

5.1 Introduction

The "National Appliance Energy Conservation Act of 1987" is a landmark piece of legislation in the United States because for the first time it sets national minimum efficiency standards for residential appliances and heating/cooling equipment. The Act is also unique in other ways:

- it was developed, written and presented to Congress by a broad-based coalition of manufacturers, energy/environment and consumer interest groups;
- it was passed by vast majorities in both houses of Congress;
- it was signed into law (after an initial veto) by a President and Administration opposed to regulation;
- it signifies a new and important trend in energy conservation policy -- the use of regulation.

The background of this Act, its provisions, coverage and implications are important for Canadian government departments, utilities, manufacturers and consumers. This section provides a summary of the highlights of this act in terms of:

- historical background,
- development and passage,
- provisions and coverage,
- impacts and consequences.

5.2 Historical Background

The first energy conservation legislation passed at the federal level in the U.S. was the Energy Policy and Conservation Act of 1975. Among other elements, this legislation required the Department of Energy (DOE) to mandate energy efficiency labelling of major residential appliances and to prescribe voluntary industry appliance efficiency improvements. In addition, the Act authorized, but did not require DOE to establish mandatory efficiency standards if necessary. According to the Act, efficiency standards would go into effect only when the following criteria were met:

- Standards must be economically justified and technologically feasible;

- Standards must result in significant conservation of energy.

While the appliance industry cooperated with the Energyguide Program, it strongly resisted the development of minimum efficiency standards, claiming that improvement was being made independently of standards, that consumers were responding to Energyguide and that a free market was the best way to conserve energy. The situation dragged on in a stalemate with industry lobbying in Washington D.C. against regulation (and also in California and New York where state governments were considering appliance regulation) and environmental/energy interest groups and some legislators pushing for action. During the Carter era, the legislative based for action was strengthened with the passage of the National Energy Conservation Policy Act of 1978 which required that energy efficiency standards be established for 13 classes of appliances. These standards pre-empt State standards which were developing at the time. In June 1980, late in the waning days of the Carter administration, the Department of Energy issued proposed standards for 8 of the 13 appliances.

However, Ronald Reagan swept to victory in November 1980, in part on a platform of deregulation and smaller government. President Reagan stayed the effectiveness of the DOE rules and sent them back to DOE for review. Vice President Bush's Regulatory Relief Task Force focused on these rules as unwarranted intrusion in the free market and DOE, under political pressure, concluded that no standards were needed and, in order to fulfull its legislated obligations, issued in 1982 the famous "no standard" standard.

However, the energy conservation lobby did not give up. It pursued two new strategies:

- state appliance regulations (under wavers of state pre-emption)
- a court challenge to the "no standard" standard.

Over the next two years, a number of state legislatures considered appliance standards and the same battles between industry and conservationists were fought out in the capitals of the following states:

- California
- Florida
- New York
- Washington
- Maine
- Rhode Island
- Minnesota
- Oregon
- Massachusetts
- New Jersey
- Connecticut

In California, New York, Maine, Massachusetts and Minnesota significant and differing appliance standards were passed with the most immediate and most stringent occurring in California. In all, some 26 states adopted some sort of appliance efficiency standards. Industry was facing a patchwork of un-coordinated regulations.

In the meantime, on July 17, 1985, the U.S. Court of Appeals, in responding to a lawsuit brought by the Natural Resources Defense Council and the Consumers Union, found that DOE had "openly violated Congressional intent" by failing to adopt national appliance standards a decade after such legislation was passed. The Court ordered DOE "to carry out faithfully its legislative charter" and to formulate a national set of standards. (See Appendix F-1 for a report of the decision.)

After this decision, facing a hodgepodge of state regulations and likely harsh federal rules, the industry (both appliance manufacturers and heating/cooling equipment manufacturers) sought out the environmental/conservation lobby to negotiate a federal bill which would:

- pre-empt all state appliance standards, yet
- contain realistic and achievable levels.

Thus was born the Coalition for Federal Appliance Efficiency Standards.

5.3 Development and Passage

The negotiations began with preliminary meetings in January 1986 and started in earnest in April 1986. They involved the following key groups:

- Association of Home Appliance Manufacturers (AHAM)
- Air-Conditioning and Refrigeration Institute (ARI)
- Gas Appliance Manufacturers Association (GAMA)
- Natural Resources Defense Council (NRDC)*
- National Audubon Society
- American Council for an Energy Efficient Economy (ACEEE)

*Lead negotiator for energy/environmental lobby

A total of 47 organizations and associations were eventually involved in the Coalition (see membership list, Appendix F-2) but one of the reasons for success was that the number of negotiating parties was kept to a minimum.

Each of the main parties entered negotiation with several objectives. On the manufacturers' side, the key objectives were:

- to reform the labelling requirements (not achieved);
- to protect self-certification programs (achieved);
- to limit coverage of Act to residential systems (achieved);
- to allow adequate lead time for federal standards, ie, 3 to 5 years (achieved);
- to establish strong federal pre-emption of state standards (achieved);
- to allow for inventory clearance of existing products after the effective date of legislation (achieved).

On behalf of the environment/conservation groups, NDRC headed the negotiations and was guided by the following objectives or criteria:

- to maximize the energy and economic savings and environmental benefits of standards (largely achieved);
- to set national standards no lower than state standards currently in effect (achieved);
- to set standards that are cost-effective to the large majority of consumers around the country (achieved);
- to provide for regular review and possible tightening of standards as they become outdated (achieved);
- to set standards that push manufacturers to the high end of energy efficient technology but to only require technologies that are already available (achieved).

Among these various objectives, most of which were met on both sides, the key bargaining issues were the level and implementation date of federal standards versus the degree of federal pre-emption of state standards. The environment/conservation groups wanted high standards implemented soon to achieve their objectives; the industry wanted strong federal pre-emption of state standard setting with limited future exemption for states in order to achieve one national uniform standard for each product. When industry offered a lower standard level, the NDRC offered lower pre-emption and vice versa. In some cases, it took several months of negotiation to achieve an agreeable balance between the two.

This is an important point for Canadian governments to recognize. While each party went in armed with its background studies and its criteria on technical and economic feasibility (which tended to set upper and lower bounds), the final actual setting of standard levels and introduction dates resulted from a process of bargaining involving other objectives and was not the result of precise engineering and economic analysis to identify optimum levels.

The bargaining process took place between April and July 1986. The easiest and quickest agreement was reached over gas furnaces and water heaters with GAMA because there were technical and efficiency barriers in these products which essentially set the standards themselves. Next came agreement with AHAM on the "white goods" appliances, upon which considerable conservation potential analysis had already been done. The most difficult and prolonged negotiations were with ARI over the air conditioners and heat pumps. This reflects the high priority placed on electricity and especially peak power demand by NDRC and other members of the environmental/conservation lobby and their insistence on high standards.

However, by July, agreement had been reached on all items and the process shifted from negotiation to legislation. In mid-August 1986, the National Appliance Energy Conservation Act of 1986, which had been drafted by Coalition lawyers in consultation with Congressional staff, was introduced to Congress and a hectic period of lobbying began. Congressional co-sponsors were found in both the House of Representatives and in the Senate and numerous lobbying meetings took place. On October 15, 1986 the Act was passed out unanimously by Congress and sent to the White House. Here, partly due to the surprise factor resulting from such rapid passage and partly due to entrenched opposition in the Office of Management and Budget, the President vetoed the Act on November 1, 1986. The veto, in fact, was termed a "pocket veto" because the 99th Congress was ending in preparation for the mid-term election and there was not opportunity for a Congressional over-ride of the veto.

Undaunted, the Coalition regrouped its forces, broadened its membership to a diverse collection of 47 organizations and held to all of the previous positions (with a few very minor changes). The National Appliance Energy Conservation Act of 1987 was re-introduced on January 6, 1987, the first day of the 100th Congress. (See Appendix F-3 for the Senate version of the Act.) This time the campaign was better organized: lobbying was more intense; press coverage was much improved; more co-sponsors were found -- enough to over-ride a possible veto (See Appendix F-4); and two former White House economists were hired to support the legislation. A target of passage within 100 days was set and the "unstoppable momentum" of this effort resulted in passage within 75 days. On March 17, 1987, President Reagan, mindful of a likely Congressional over-ride if he again vetoed the bill, signed the Act into law.

5.4 Coverage and Provisions

The Act covers the following products:

- Refrigerators and refrigerator-freezers
- Freezers
- Kitchen ranges and ovens
- Dishwashers
- Clothes washers
- Clothes dryers
- Water heaters
- Furnaces
- Room air conditioners
- Central air conditioners and heat pumps
- Direct heating equipment
- Pool heaters
- Television sets (no standards set)

There is also provision for the Secretary of Energy to designate other products as covered in the future.

In general, the Act sets standards on minimum efficiency, maximum consumption or (in some cases) prescribed design which come into effect in 1988 or 1990 for design standards, in 1990 for consumption standards on refrigerators and freezers, and in either 1990, 1992 or 1993 for various heating/cooling products. The details of the standards for each product are shown in Table 5.1: Summary of Standards in U.S. National Appliance Energy Conservation Act of 1987.

The standards are to remain in effect for 3 to 10 years, depending on the product. After this 3 to 10 year "lock in" period, DOE may promulgate new standards for each product which may not be less than those established by the legislation. The standards, in most cases, are as strong as, or stronger than State standards currently in effect. (For example, see Table 5.2: National Appliance Energy Conservation Act of Standards).

In general, these national standards preempt all State standards. However, States may petition DOE for a waiver from the Federal standards. Moreover, State standards enacted before January 8, 1987, and which become effective before January 3, 1988, are "grandfathered" by the bill and will remain effective until the appropriate Federal standard begins. States may petition DOE to be waived from Federal preemption, but achieving the waiver is difficult. In order to receive a waiver a State must show that its regulation is needed to meet "unusual and compelling State and local interests."

One other important provision to note is that the regulations apply to the "manufacture" of products not to their "sale". This is designed to allow manufacturers to clear inventory of non-conforming products after the effective date of a given regulation (eg, 1990 for refrigerators and freezers) but not to manufacture any more non-conforming models after that date. In the two earlier pieces of legislation to which this act is attendant, "manufacture" is defined as "manufacture or importation for the purposes of sale" and provision is also made for U.S. manufacture of non-conforming product which is destined

TABLE 5.1
SUMMARY OF STANDARDS IN U.S. NATIONAL APPLIANCE ENERGY CONSERVATION ACT OF 1987

PRODUCT	EFFECTIVE DATE	TYPE	STANDARD		EXPLANATION
. Refrigerators and Refrigerator-Freezers	Jan 1, 1980	Consumption (annual kWh)	Refrigs & Refrig-Freezers with manual defrost...	16.3 AV + 316	AV = 1.44 freezer vol + frig vol
			Refrig-Freezers-partial automatic defrost.......	21.8 AV + 429	
			Refrig-Freezers-automatic defrost with..........		
			Top mounted freezer without ice..............	23.5 AV + 471	AV = 1.63 freezer vol + frig vol
			Side mounted frezer without ice..............	27.7 AV + 488	
			Bottom mounted freezer without ice...........	27.7 AV + 488	
			Top mounted freezer with through the door ice service..................................	26.4 AV + 535	
			Side mounted freezer with through the door ice	30.9 AV + 547	
. Freezers	Jan 1, 1990	Consumption (annual kWh)	Upright Freezers with:		
			Manual defrost................................	10.9 AV + 422	AV = 1.73 freezer vol
			Automatic defrost.............................	16.0 AV + 623	
			Chest Freezers and all other freezers...........	14.8 AV + 223	
. Ranges and ovens - gas	Jan 1, 1990	Design	no pilot lights		applies to all ranges and ovens with electrical supply cord
. Dishwashers	Jan 1, 1988	Design	option to dry without heat		
. Clothes Washers	Jan 1, 1988	Design	rinse cycle must include unheated water option		rinse cycle may include heated water option

PRODUCT	EFFECTIVE DATE	TYPE	STANDARD	EXPLANATION
. Clothes Dryers - gas	Jan 1, 1988	Design	no pilot light	
. Furnaces	Jan 1, 1992	Efficiency (annual)	78% AFUE (75% AFUE for mobile home furnaces)	AFUE = annual fuel utilization effic.
. Boilers	Jan 1, 1992	Efficiency (annual)	80% AFUE	
. Boilers - gas steam	Jan 1, 1992	Efficiency (annual)	68% AFUE	
. Central Air Conditioners and Heat Pumps				
- Split	Jan 1, 1992	Efficiency	10.0 SEER (cooling); 6.8 HSPF (heating)	SEER = seasonal energy efficiency ratio
- Single Package	Jan 1, 1993	Efficiency	9.7 SEER (cooling); 6.6 HSPF (heating)	HSPF = heating seasonal performane factor
. Water Heaters	Jan 1, 1990	Efficiency (energy factor)	(A) Gas Water Heater: .62 - (.0019xRated Storage Volume in gallons) (B) Oil Water Heater: .59 -(.0019xRated Storage Volume in gallons) (C) Electric Water Heater: .95-(.00132xRated Storage Volume in gallons)	EF = energy factor

PRODUCT	EFFECTIVE DATE	TYPE	STANDARD		EXPLANATION
. Room Air Conditioners	Jan 1, 1990	Efficiency	Product class	EER	EER = Energy efficiency ratio
			Without Reverse Cycle and with Louvered Sides:		
			Less than 6,000 Btu	8.0	
			6,000 to 7,999 Btu	8.5	
			8,000 to 13,999 Btu	9.0	
			14,000 to 19,999 Btu	8.8	
			20,000 and more Btu	8.2	
			Without Reverse Cycle and Without Louvered Sides:		
			Less than 6,000 Btu	8.0	
			6,000 to 7,999 Btu	8.5	
			8,000 to 13,999 Btu	8.5	
			14,000 to 19,999 Btu	8.5	
			20,000 and more Btu	8.2	
			With Reverse Cycle and With Louvered Sides	8.5	
			With Reverse Cycle, Without Louvered Sides	8.0	
. Pool Heaters	Jan 1, 1990	Efficiency	78% thermal efficiency		steady state thermal effic.
. Gas Direct Heating Equipment	Jan 1, 1990	Efficiency	Wall		
			Fan type		
			Up to 42,000 Btu/hour	73% AFUE	
			Over 42,000 Btu/hour	74% AFUE	
			Gravity type		
			Up to 10,000 Btu/hour	59% AFUE	
			Over 10,000 Btu/hour up to 12,000 Btu/hour	60% AFUE	

PRODUCT	EFFECTIVE DATE	TYPE	STANDARD	EXPLANATION
			Over 12,000 Btu/hour up to 15,000 Btu/hour.......61% AFUE	
			Over 15,000 Btu/hour up to 19,000 Btu/hour.......62% AFUE	
			Over 19,000 Btu/hour up to 27,000 Btu/hour.......63% AFUE	
			Over 27,000 Btu/hour up to 46,000 Btu/hour.......64% AFUE	
			Over 46,000 Btu/hour.............................65% AFUE	
			Floor	
			Up to 37,000 Btu/hour............................56% AFUE	
			Over 37,000 BTU/hour.............................57% AFUE	
			Room	
			Up to 18,000 Btu/hour............................57% AFUE	
			Over 18,000 Btu/hour up to 20,000 Btu/hour.......58% AFUE	
			Over 20,000 Btu/hour up to 27,000 Btu/hour.......63% AFUE	
			Over 27,000 Btu/hour up to 46,000 Btu/hour.......64% AFUE	
			Over 46,000 Btu/hour.............................65% AFUE	

exclusively for export and is so labelled. These provisions have the effect of preventing the importation of non-conforming products but allowing the manufacture of non-conforming products exclusively for export. Thus, Canadian products exported to the U.S. market must meet the standards but U.S. companies, if they so choose, could export non-conforming products to Canada. This "dumping" of inefficient products on the Canadian market is, however, highly unlikely given the ability to clear inventory within the U.S. when given standards come into effect and the small size of the Canadian market which would not justify a separate model line for export to Canada. This issue is further explored in Section 6.

5.5 Impacts and Consequences

The impacts and consequences of this Act in the United States are several and significant. (Impacts in Canada are considered in Section 6.)

Firstly, the regulations under the Act are substantial, even tough in some cases. They will result in a significant increase in the efficiency of the products covered. Table 5.2: National Appliance Energy Conservation Act of Standards shows current (1984) efficiency levels for several products, the act efficiency, the resultant average efficiency and the percent improvement. It also compares the Act efficiencies with those in several State laws.

Secondly, a large proportion of the current model offerings do not meet the new standards when they come into effect. Table 5.3: Redesign Requirements of Appliance Standards in the National Appliance Energy Conservation Act shows the percent of models on the market in 1986 that will not meet the new standard. For example, 89% of current refrigerators (top freezer, auto defrost) do not meet the 1990 standard, nor do 79% of gas furnaces meet the 1992 standard. This means that the regulations will:

TABLE 5.2

NATIONAL APPLIANCE ENERGY CONSERVATION ACT OF STANDARDS

Appliance type	1984 average efficiency	Minimum efficiency required by Act	Resulting average market efficiency	State efficiency	Percent(1) efficiency
Refrigerators	1140 kWh/yr	976 kWh/yr	903 kWh/yr	1023 kWh/yr *(CA '87)* 722 kWh/yr *(CA '92)*	21
Freezers	799 kWh/yr	671 kWh/yr	621 kWh/yr	737 kWh/yr *(CA '87)* 511 kWh/yr *(CA '92)*	22
Room Air Conditioners	7.5 EER	8.6 EER	9.3 EER	8.4 EER *(CA '79)* 8.45 EER *(NY '88-prop)* 8.7 EER *(NY' 92-prop)*	19
Central Air Conditioners	8.8 SEER	10.0 SEER	10.3 SEER	9.5 SEER *(NY '85)* 9.9 SEER *(CA '93)*	17
Water Heaters:					
Gas	.484 EF	.544 EF	.554 EF	.524 EF *(ASHRAE/CA)*	13
Electric	.807 EF	.884 EF	.894 EF	.864 EF *(ASHRAE/CA)*	10
Furnaces	70% AFUE	78% AFUE	84% AFUE	71% AFUE *(CA '78)*	20

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[1] Percent change 1984 vs. resulting average market efficiency.
Revised September 12, 1986

TABLE 5.3

REDESIGN REQUIREMENTS OF APPLIANCE STANDARDS IN THE NATIONAL APPLIANCE ENERGY CONSERVATION ACT

APPLIANCE AND PRODUCT CATEGORY	PERCENT REDESIGN
Refrigerators[1] (includes models with through-the-door ice):[2]	
Top-freezer, auto defrost[2]	89
Side-freezer, auto defrost[2]	92
Manual defrost	42
Freezers:[1]	
Chest	83
Upright manual	87
Room air conditioners:[3]	
No reverse cycle - with side louvers	
Less than 6,000 Btu/hr	78
6,000 to 7,999 Btu/hr	49
8,000 to 13,999 Btu/hr	56
14,000 to 19,999 Btu/hr	81
20,000 Btu/hr and over	60
Reverse cycle - without side louvers	
Less then 6,000 Btu/hr	0
6,000 to 7,999 Btu/hr	45
8,000 to 13,999 Btu/hr	76
14,000 to 19,999 Btu/hr	100
20,00 Btu/hr and over	(2)
Reverse cycle - without side louvers	0
Central Air Conditioners:[4]	
Split system	[5]90
Package system	[6]89
Furnaces:[6]	
Oil burner	57
Oil furnace	58
Gas boiler	79
Gas furnace	79

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[1] NRDC sort of AHAM 1986 Directory of Certified Refrigerators and Freezers, Edition No.2. June, 1986.

[2] No models offered.

[3] NRDC sort of AHAM 1986 Consumer Selection Guide for Room Air conditioners. The earlier version of this table contained an error which omitted the redesign percentages for air conditoners over 20,000 BTU/hr and subetituted the percent redesign for the Reverse Cycle with Side Louvers category, which in turn was left blank. Other small variations in the redesign numbers reflect differences with the AHAM sort which includes Special Application Models and other unique classes which were not considered in the original NRDC sort.

TABLE 5.3 *(continued)*

4 ARI 3rd Quarter 1985 Efficiency Statistics of Nationally-shipped units Figure 4 of ARI Submission to Massachusetts Executive Office of Energy Resources, March 1986.

5 These figures refer to shipments, not models.

6 Sort of GAMA Consumers' Directory of Certified Furnace and Boiler Efficiency Ratings, May 1986, done by Glenn Reed, Massachusetts Executive Office of Energy Resources. These numbers differ from the previous version of this table, because they were based on an AFUE of 78% according to GAMA's indoor air/indoor furnace test. Since the bill specifies 78% AFUE using outdoor air, the rule-of-thumb adjustment to the indoor test is 2% AFUE upward. Thus the sort is computed at the 80% AFUE level in this version, not the 78% AFUE level.

Revised September 12, 1986.

- clear the market of inefficient models (in many cases, the bulk of current offerings); and
- stimulate the use of new technology and new product development to meet the requirements.

Thus future energy savings will be guaranteed by two mechanisms: the removal of inefficient models from the market; and the development of new higher-efficiency products and technologies.

Thirdly, the magnitude of the energy and economic impacts of the Act is impressive. Table 5.4: Forecast of Future Energy Consumption of Appliances was developed by Howard Geller of the American Council for an Energy Efficient Economy. It examines the impact of the Act (ie, a standards scenario minus a marketplace scenario) on 8 of the 12 products and shows the savings expected by the year 2000 in terms of:

- electricity - energy and peak,
- total energy (electricity and gas),
- net cost savings.

To put these savings in perspective, the 22,000 MW reductions in the year 2000 nationwide peak is equal to 10% of the expected growth in peak demand between 1985 and 2000. The annual saving of approximately 1 Quad in total energy consumption by the year 2000 compares to a current annual consumption of 75 Quads. The savings over the lifetime of products sold between now and the year 2000 is estimated to be 15 Quads. The cost savings by the year 2000 of $28 billion are net savings to consumers in 1985 dollars ($42 billion in energy savings minus $14 billion in extra first cost for the more efficient appliances). In fact, this figure is likely an underestimate because the energy savings over the period are valued at the current average national price (ie, not escalated) and the extra first costs are today's differential. Most industry officials acknowledge that the extra first costs will drop significantly once the standards are in place, due to the economies of scale. In this case, the net savings to consumers could be as high as $40 billion.

TABLE 5.4

FORECAST OF FUTURE ENERGY CONSUMPTION OF APPLIANCES

Product	Electricity Savings by 2000			Energy Savings by 2000		Cost Savings by 2000
	Annual Twh/yr	Lifetime (Twh)	Peak MW	Annual (Tbtu/yr)	Lifetime (quads)	Net lifetime $ X 10[1]
Refrigerators	13.86	263	1,851	159.39	3.02	$5,696
Freezers	2.59	54	340	29.79	0.62	1,358
Electric Water Heaters	20.87	271	2,573	240.01	3.12	8,798
Room Air Conditioners	4.59	69	4,890	52.79	0.79	854
Central Air Conditioners	11.62	139	12,385	133.63	1.60	829
Furnaces				121.78	2.80	3,010
Gas Water Heaters				190.19	2.47	6,280
Gas Ranges				31.83	0.57	1,325
Total	**53.53**	**796**	**22,039**	**959.40**	**14.99**	**28,150**

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[1] Net Lifetime, dollars X 10^6

Source: American Council for an Energy Efficient Economy, "Energy and Economic Savings Potential From National Appliance Efficiency Standards" (August 1986).

Fourthly, the overall benefit/cost ratio for the adoption of standards for the 8 appliances shown in Table 5.4 are shown below. Again, the benefits are the value of total energy savings at today's rates compared to the total incremental cost for products at today's differential prices.

Product	Benefit/Cost Ratio
Refrigerators	3.4
Freezers	5.9
Electric Water Heaters	8.1
Room Air Conditioners	1.3
Central Air Conditioners	1.2
Furnaces	1.9
Gas Water Heaters	8.7
Gas Ranges	7.1
Total:	3.0

Fifth, the electrical utilities in the U.S. strongly supported this Act because they are beneficiaries in several ways. They can benefit by the energy and peak demand savings, forego the need for expensive new generation plants and undertake forecasts with much greater certainly.

Lastly, the environment is also positively impacted. Reduced energy demands and especially electrical demand will proportionately reduce pollution emissions from existing plants and obviate the need for new plants. This reduction in capital requirements for system expansion will also free up capital which may be applied to such programs as acid rain controls.

6.0 ASSESSMENT OF COMPETITIVE THREAT

6.1 Introduction

In this section, an assessment is made of the implications for Canada of technological change and the recent U.S. legislation on appliance efficiency standards.

Firstly, a number of factors are reviewed concerning the Canadian and American industry, the respective product efficiencies, the state of technology and the U.S. legislation.

Secondly, the major impacts of the U.S. legislation on Canada are identified and discussed.

Thirdly, the likely impacts of the possible adoption of Canadian appliance standards (similar to those in the U.S) are identified.

6.2 Factors

The following factors are felt to be relevant to the issues at hand.

. Canadian imports	- Canada is a significant importer of appliances, most notably: . refrigerators - 18% of domestic sales . clothes washers - 17% of domestic sales . dishwashers - 12% of domestic sales . clothes dryers - 10% of domestic sales - These imported appliances tend to be the high quality models with extra features and proven durability. They seem to maintain a significant market share despite a 12.5% tariff and a 75¢ Canadian dollar.

- In heating/cooling equipment, Canada seems to be more self-sufficient, although there are some air conditioners, heat pumps and furnaces imported. The volume of imports will likely grow with the recent closure of manufacturing facilities by two U.S.-based air conditioning/heat pump manufacturers (Carrier and York).

. Canadian exports

- Canada is a significant exporter of high-efficiency freezers to the U.S., accounting for about 30% of domestic production (estimate).
- These freezers are produced mainly by two smaller, wholly Canadian-owned companies which have secured a niche in the U.S. market.
- Canada also exports about 12% of its clothes dryer production.
- Canadian appliance exports to the U.S. do not currently face significant tariffs; rather, the restriction is much more corporate policy. The Canadian branch plants of American-based parents operate under mandates confined to the Canadian market and currently do not export significant quantities to the U.S.
- Canada exports limited quantities of high efficiency gas furnaces to the U.S. market (Clare Brothers and Lennox). Clare makes some of the most efficient gas furnaces on the U.S. market.

- Industry ownership and structure
  - The Canadian appliance industry is concentrated in 3 large, "full-line" companies which are subsidiaries of their foreign parent companies.
  - There are also two small, wholly Canadian-owned freezer companies.
  - The Canadian-based plants are not as large as their U.S. counterparts and cannot achieve the same economies of scale in supplying domestic markets alone.
  - To the degree that the Canadian industry is competitive, this is a result of import tariffs and the exchange rate.
  - The Canadian heating/cooling equipment industry is more diverse and considerably more Canadian-owned than the appliance industry. However, many of the large companies have U.S. majority ownership.
- Canadian product energy efficiency
  - The efficiency of most major appliances produced by Canadian branch plants is significantly lower than those produced by the American industry.
  - The exception to this rule is the freezers produced by the two small Canadian-owned freezer companies which also export to the U.S.
  - Most Canadian production lines have not been re-tooled for energy efficiency.

	- Canadian furnace efficiency is comparable to that in the U.S. with state-of-the-art furnaces available in each country.
	- In air conditioners and heat pumps, however, it is likely that Canadian product efficiencies lag behind those in the U.S. Lack of comprehensive data in Canada makes comparison difficult.
	- In water heaters, Canadian products are not labelled nor are test results divulged. Some products on the U.S. market are known to be of higher efficiency than the Canadian market. Overall, it is likely that we lag behind somewhat.
. Canadian R&D	- Very little R&D on appliance efficiency takes place in Canada; the vast majority comes from the parent companies in the U.S. Canada appears to be in a technological lag on appliance efficiency.
	- Considerable Canadian R&D has taken place on high-efficiency furnaces and Canadian climate heat pumps. Very little has been done on air conditioners.
. Japanese efficiency	- The efficiency of Japanese refrigerators, while not as outstanding as the Japanese test data indicates (due to significant differences in the test method) is nonetheless impressive. In the smaller sizes, Japanese refrigerators are more efficient than the best U.S. models and substantially more efficient than Canadian models.

. Japanese competitive threat	- The Japanese industry is not considered to represent a significant competitive threat to Canadian industry, at least in the short to medium term. Their products are generally too small for Canadian or American consumer requirements. Furthermore, shipping is prohibitively expensive due to the "low density". North American-based plants are unlikely because of the already "saturated" nature of the North American appliance market (except for new products such as microwave ovens).
. U.S. legislation	- The new U.S. legislation will significantly raise the efficiency of U.S. appliances and heating/cooling equipment. - It will clear the U.S. market of low efficiency products. - It will stimulate research, product development and fairly massive investment in retooling of U.S. production lines. - It will also produce substantial energy and economic benefits for the U.S. economy.

6.3 Impacts of U.S. Legislation on Canada

Based on the foregoing factors and the background information presented in previous sections, it is possible to identify the following impacts (or lack of impact) of the new U.S. appliance efficiency legislation on Canada.

6.3.1 No Dumping of Inefficient Appliances into Canada: For some time, there has been concern that U.S. manufacturers would dump inefficient products on the Canadian market when the new U.S. standards come into effect. This will not happen to any significant extent for the following reasons:

- The U.S. legislation covers "manufacture" of appliances, not "sale" and was specifically designed to allow manufacturers to "clear" existing non-conforming models on the domestic market after the effective date of the standard. Thus, there is little incentive to ship units to Canada when they can be legally sold in the U.S.

- While the legislation does make provision for U.S.-based manufacture of non-conforming products exclusively for export, all U.S. appliance manufacturers consulted stated that it would not be worthwhile for any company to dedicate or build a production line just to produce lower efficiency appliances for the small Canadian market.

One minor permutation of this situation is that the Canadian plants of U.S. parent companies might be used to fulfill the Canadian market for non-conforming products and any overseas export market that exists. However, the small size of this export market and the overseas shipping costs render this outcome unlikely.

6.3.2 Loss of Competitiveness in U.S. Markets: The new U.S. Act prohibits "importation for the purposes of sale" of non-conforming products. Therefore, to the extent that Canadian-built products cannot meet the standard, they will lose their export markets. Even in an area such as freezers, where Canada exports energy-efficient models, and currently has an advantage, the rising standard in the U.S. will introduce domestic competition for Canada's share of that market. Overall, Canadian exporters to the U.S. will either lose their market entirely, be forced to upgrade efficiency or, at the least, face stiffer competition in their U.S. market niches.

6.3.3 **Increase in Efficiency of Imported Appliances:** The U.S. legislation will be raising the efficiency of products produced in the U.S. This effect will spill over into the Canadian market as the efficiency of exports to Canada also increases along with the general U.S. product trends. To this extent, energy conservation in Canada will benefit from the U.S. legislation. Higher efficiency U.S. products may also increase their share of the Canadian market to the extent that Canadian consumers opt for high-efficiency products. In this situation, and without a corresponding increase in Canadian product efficiency, Canadian manufacturers would lose sales and market share.

6.3.4 **Canada Further in Technological Lag:** The U.S. legislation will trigger development and investment in new technologies and products in the United States. Multinational firms will be concentrating their R&D and capital resources on retooling their U.S. manufacturing facilities. Canadian plants will fall still further behind in terms of R&D, new product development and the modernization of production processes. Such technology may eventually be transferred to Canadian branch plants, as is currently the practice, but for the short to medium term Canadian plants will lag even further in efficiency technology.

6.4 Impacts of Possible Canadian Appliance Standards

The adoption, by provincial and/or federal governments, of Canadian appliance efficiency standards similar to those in the U.S. would have the following types of effects in Canada.

6.4.1 **Acceleration of Technology Transfer:** Under conditions where the same or similar efficiency standards existed in Canada as in the U.S., the technology to meet those standards would be transferred more rapidly from the U.S. parents to the Canadian subsidiaries. This would significantly improve the technological and competitive position of the Canadian companies.

6.4.2 **Investment in Re-tooling:** In order to meet new standards in Canada, production lines would also have to be re-tooled to install the new technologies and production processes. The capital investment required for this re-tooling would come in part from Canadian manufacturers (perhaps creating some financial difficulties) but also from the American parent companies. In effect, standards in Canada would be an additional factor in the decision of U.S. manufacturers to invest in the upgrading of their Canadian operations as well as their domestic facilities.

6.4.3 **Improved Efficiency of Canadian Products:** Meeting efficiency standards similar to those in the U.S. legislation would significantly improve the efficiency of products on the Canadian market (especially in certain products such as refrigerators where we lag far behind). Inefficient products would be removed from the market (eg. conventional gas furnaces) and the efficiency of other products would be improved. The result would be a more energy-efficient Canadian marketplace and significant residential energy savings. In fact, the amount of energy saved in Canada will likely be proportionately larger than in the U.S., due to our lagging product efficiencies and lower market penetrations.

6.4.4 **Increased Costs - Increased Savings:** Meeting new Canadian efficiency standards would impose somewhat increased product costs on Canadian consumers. It must be noted, however, that incremental costs are often small and, when efficiency improvements are implemented across a whole model range, economics of scale bring these costs down significantly. In any case, increased first costs to consumers are offset by energy savings over the product's life.

6.4.5 **Maintenance of Competitiveness and Employment:** Adoption of efficiency standards in Canada would mean that our export products would continue to have access to and be competitive in U.S. markets. Furthermore, investment would be stimulated in the Canadian industry resulting in more efficient products for the domestic market that are able to compete against high-efficiency U.S. models. Thus, standards would protect Canadian markets against imports (including possible Japanese imports) and would maintain both short-term and long-term employment in the Canadian appliance and heating/cooling equipment industries. Failure to adopt, or even delay in adopting, such standards will likely mean an increase in imports to Canada and a loss of market share and employment in our domestic industry.

6.5 Other Factors

There are, of course, other interacting factors which will influence the competitiveness and the product energy efficiency of the Canadian appliance industry and the nature of the Canadian market. These factors include:

- the possibility of a free trade agreement between Canada and the United States, the exact impact of which would depend on the extent of such an agreement, the industries covered, the timing and phase in period, etc.;
- the negotiation of future product mandates by the Canadian subsidiaries of U.S. based companies, in part dependent on a free trade agreement and other factors of competition;
- corporate takeovers, such as the recent purchase of WCI (U.S.) by A.B. Electrolux of Sweden, and the influence that such changes in ownership and direction will have in Canada.

Such factors are beyond the scope of this report which was aimed primarily at developing an information base describing the current situation in Canada.

APPENDIX A

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APPENDIX A

BIBLIOGRAPHY

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APPENDIX B

SERF DETAILED APPLIANCE SALES FORECAST

WATSRF Waterloo Simulation Research Facility

Computer Simulations of Long Term Canadian Futures

March 9, 1987

Mr. Brian Kelly,
Marbek Resource Consultants Ltd.,
2211 Riverside Drive,
Ottawa, Ontario,
K1H 7X5.

Dear Brian:

Here are the results, in tabular form, and plotted against the CAMA projections. Please note several things:

1. Forcing a calibration with CAMA in 1986 does wierd things to our pre 1986 and post 1980 numbers. Remember SERF doesn't pick up short term fluctuations like the 81-3 recession without a lot of calibration.
2. Since we don't know what drives the CAMA numbers (# of households, persons per household, population, etc.), we can't meaningfully compare these numbers.
3. Our projections are higher than CAMA for everything except microwaves. Note that, with the same exception, we hold saturation levels constant after 1986. Therefore, the differences must be demographic (assuming CAMA holds lifetimes constant). This suggests they are assuming lower household formation rates.
4. With regard to microwaves, we assume saturation levels of about 60% by 2000. I assume that CAMA goes much higher.
5. This exercise points out the importance of demographics and of doing a proper analysis and comparison which there is not the budget or time to do.

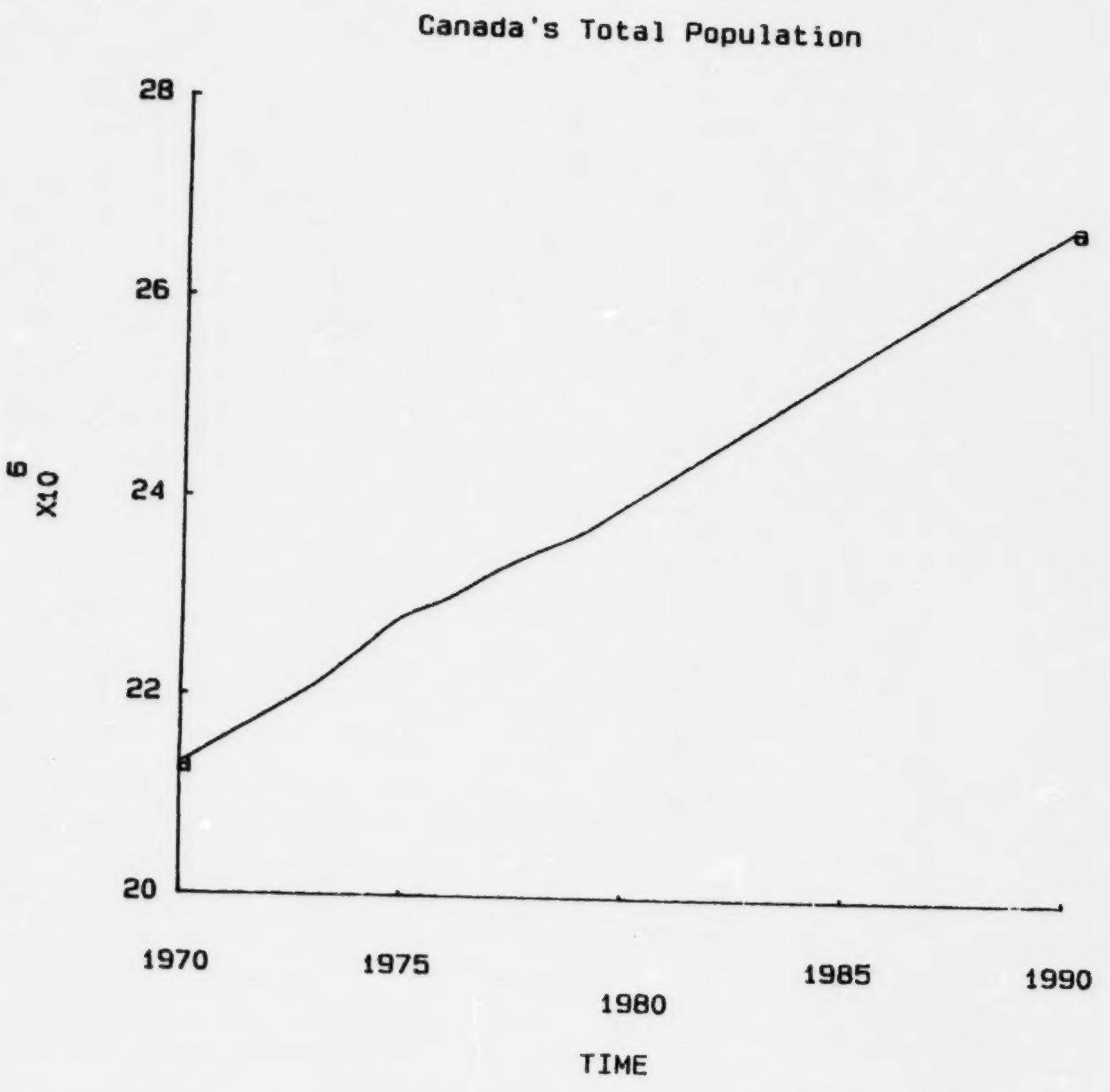
All the best,

John B Robinson /llc.

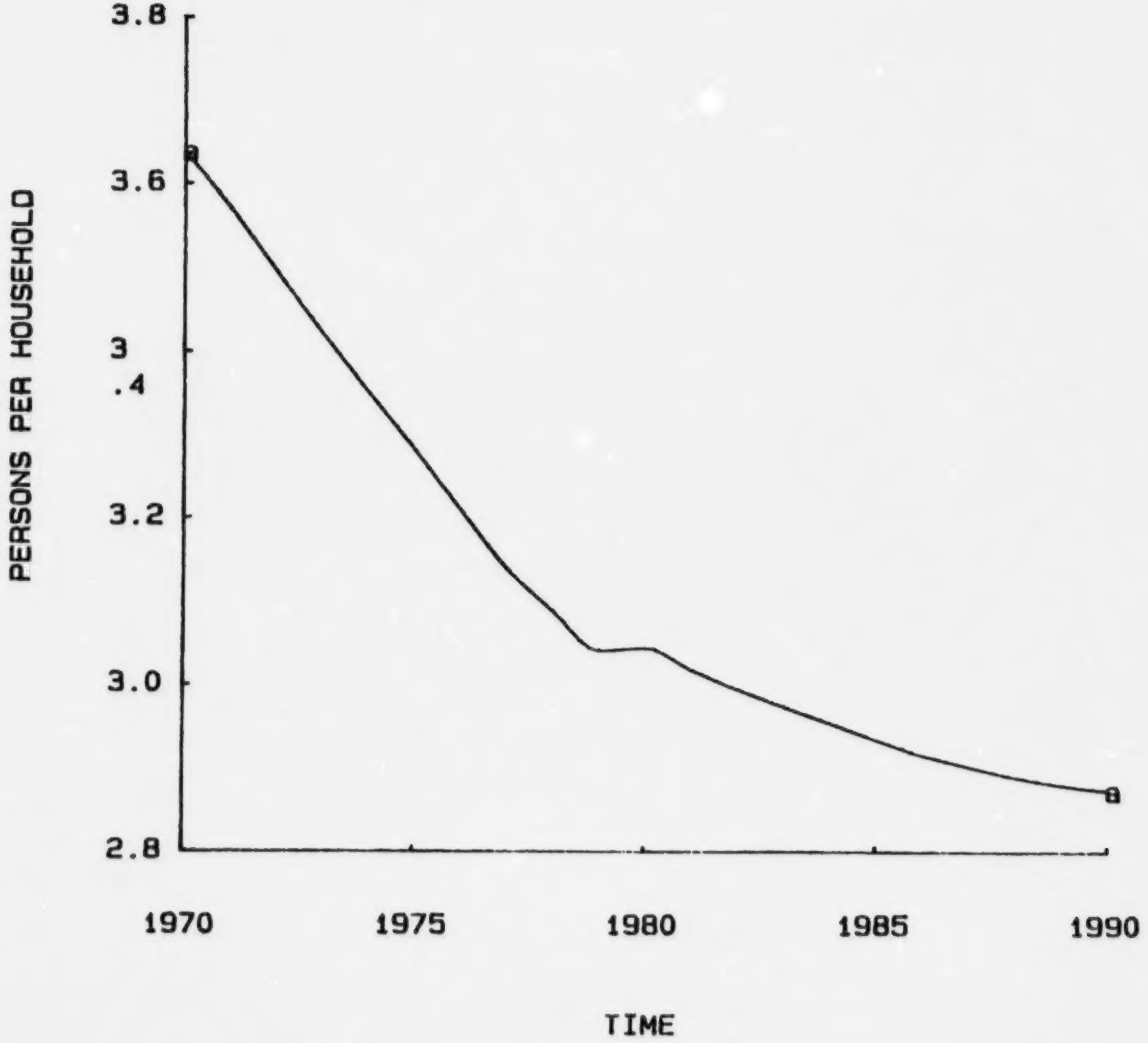
John B. Robinson,
Associate Professor.

Encl.
/llc

Environmental Studies, ES107F University of Waterloo Waterloo, Ontario, Canada N2L 3G1 (519) 885-1211 Ext. 2962

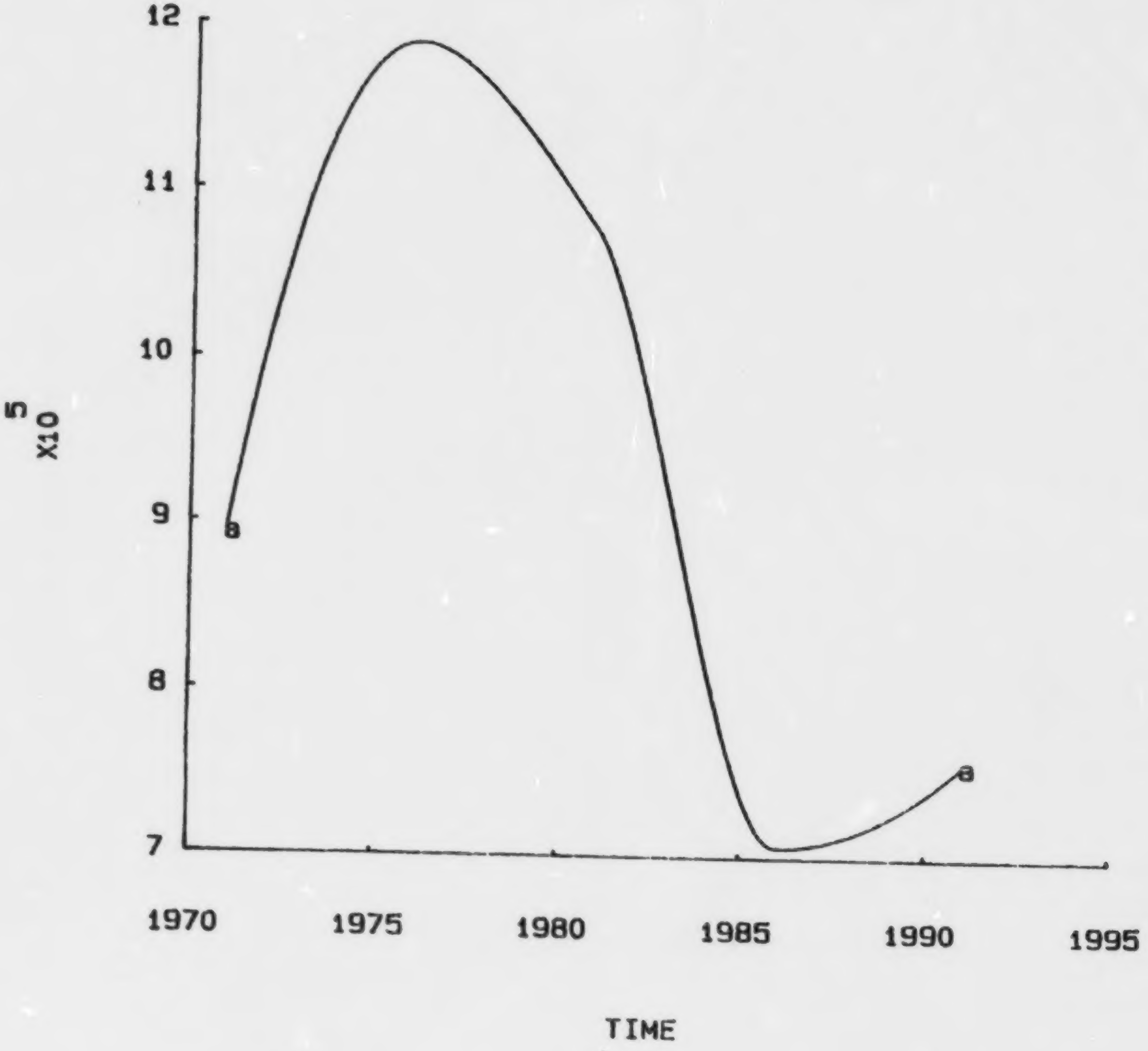

Canada's Total Population

HISTORICAL AND PROJECTED



Newhouse Starts

Historical and Projected



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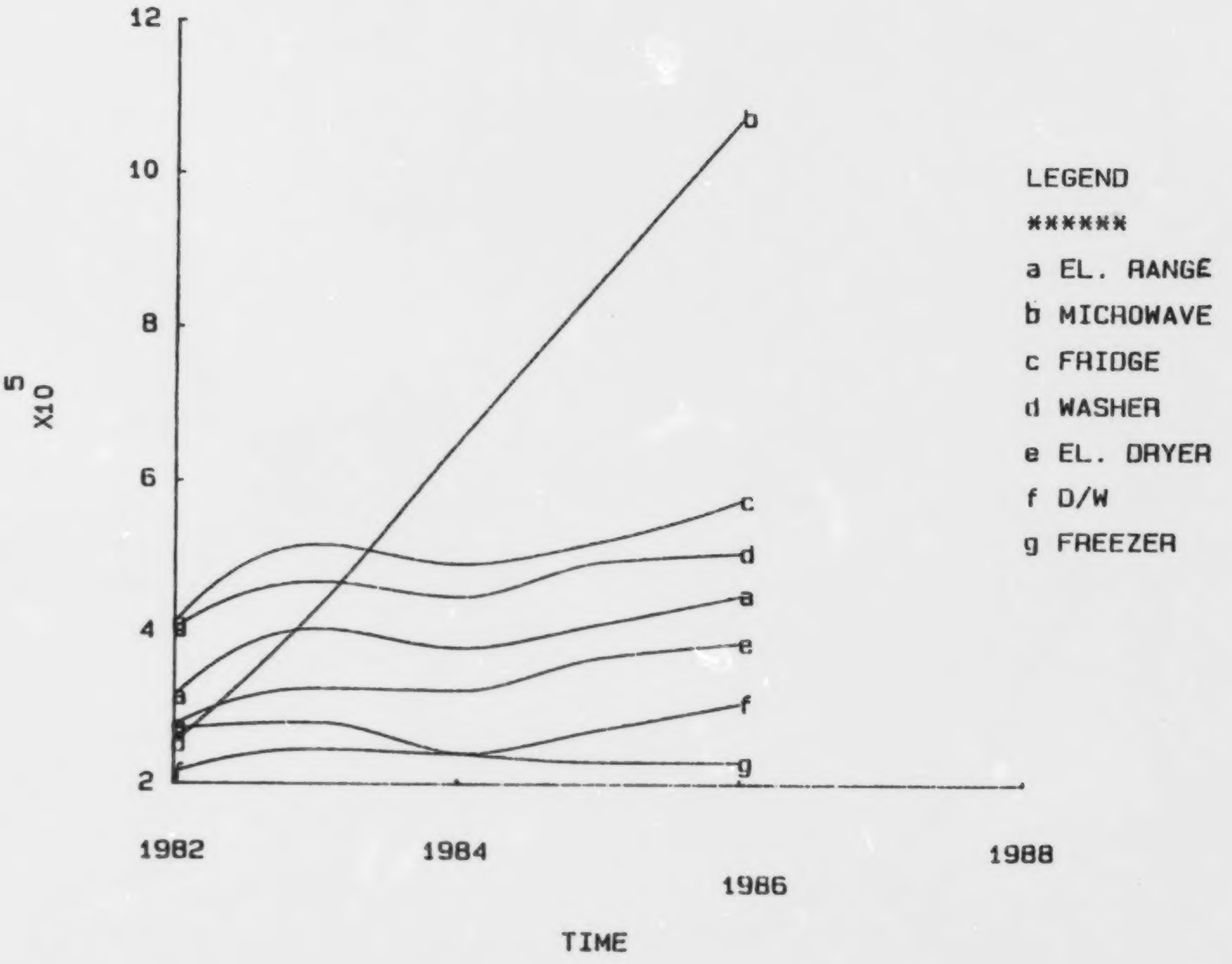

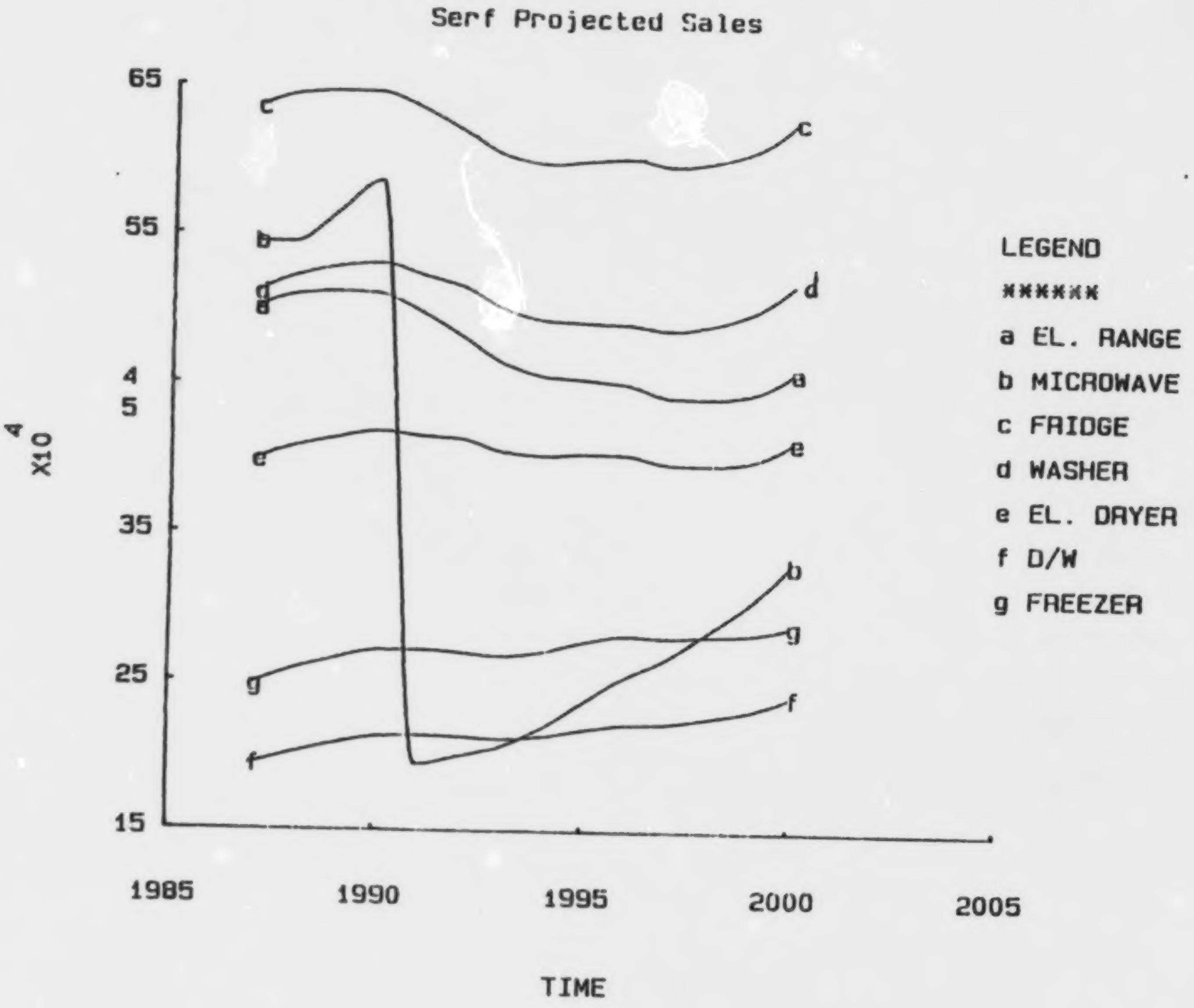
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65
55
4
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35
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4
1985
1990
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2000
2005
TIME
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a
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LEGEND
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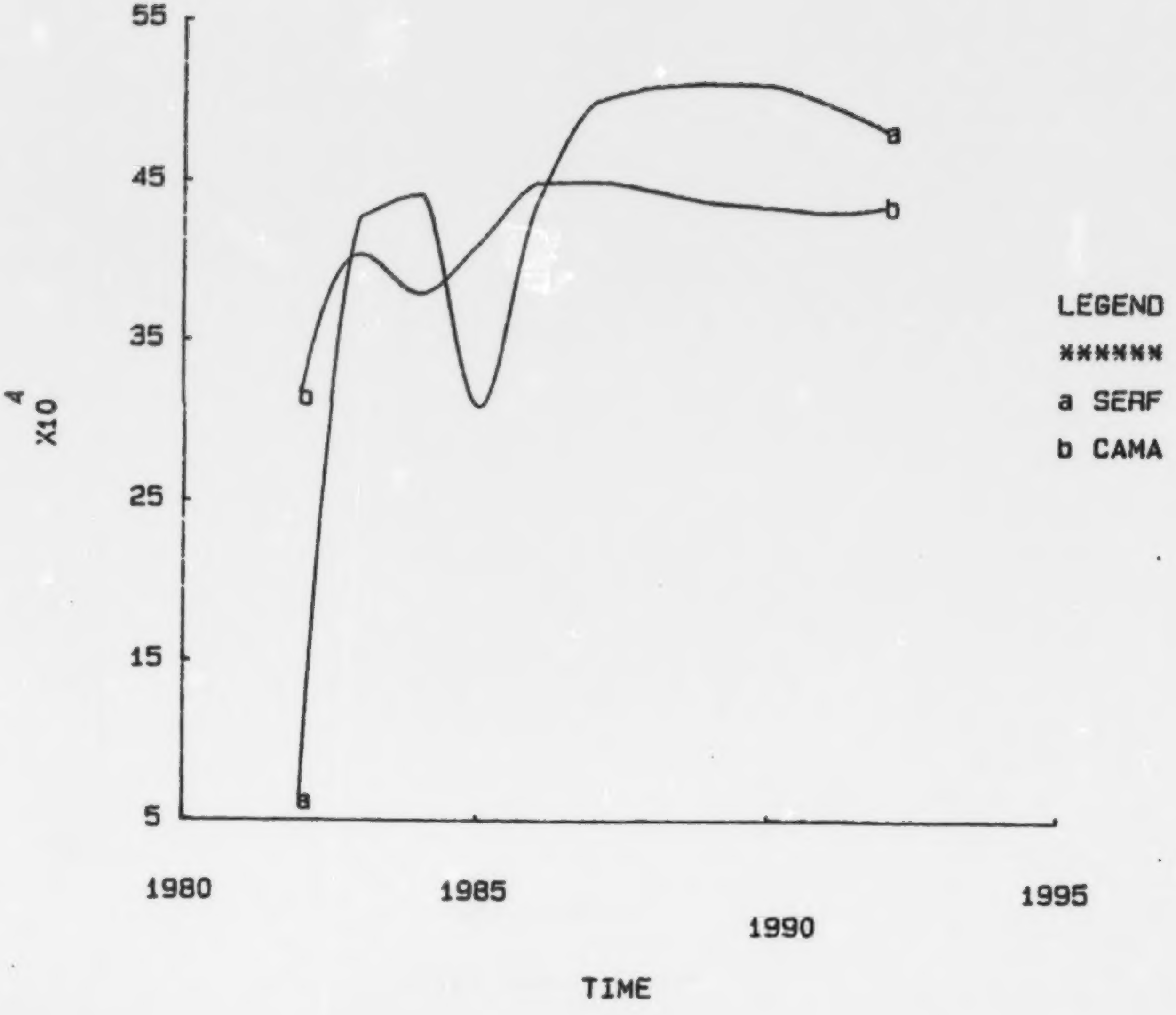
a EL. RANGE
b MICROWAVE
c FRIDGE
d WASHER
e EL. DRYER
f D/W
g FREEZER

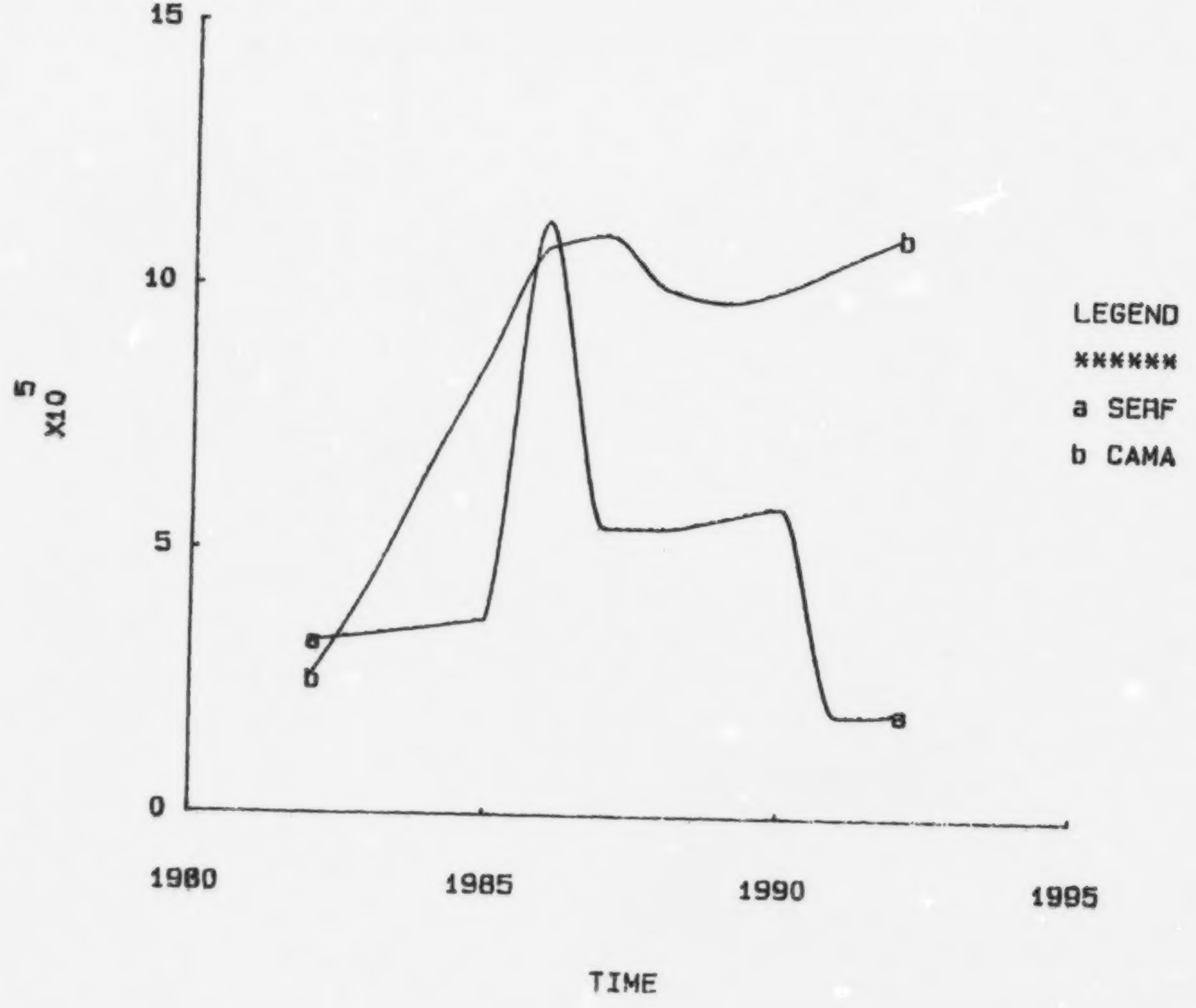
Sales Projections

Electric Ranges



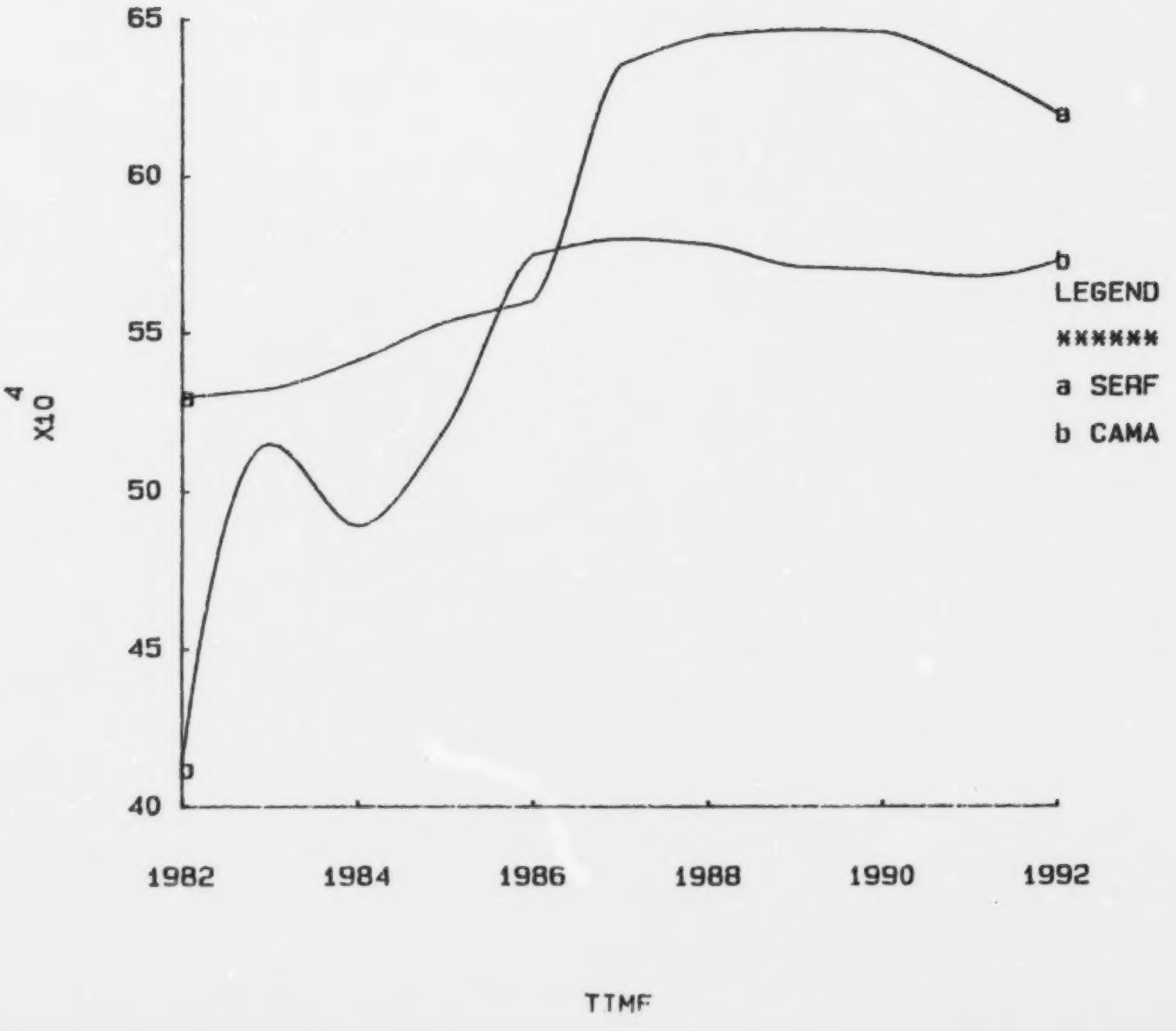
Sales Projections

Microwaves



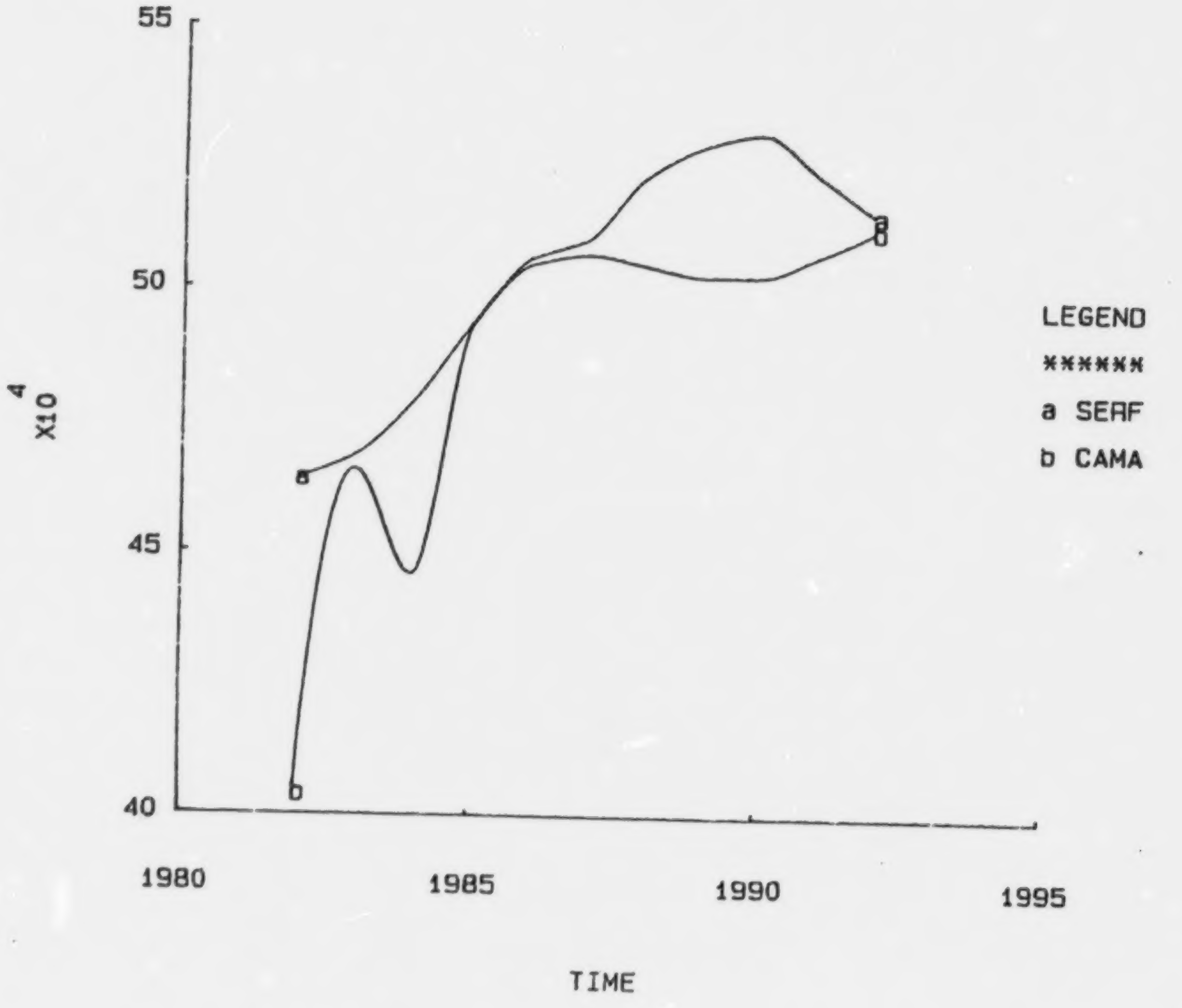
Sales Projections

Refrigerators



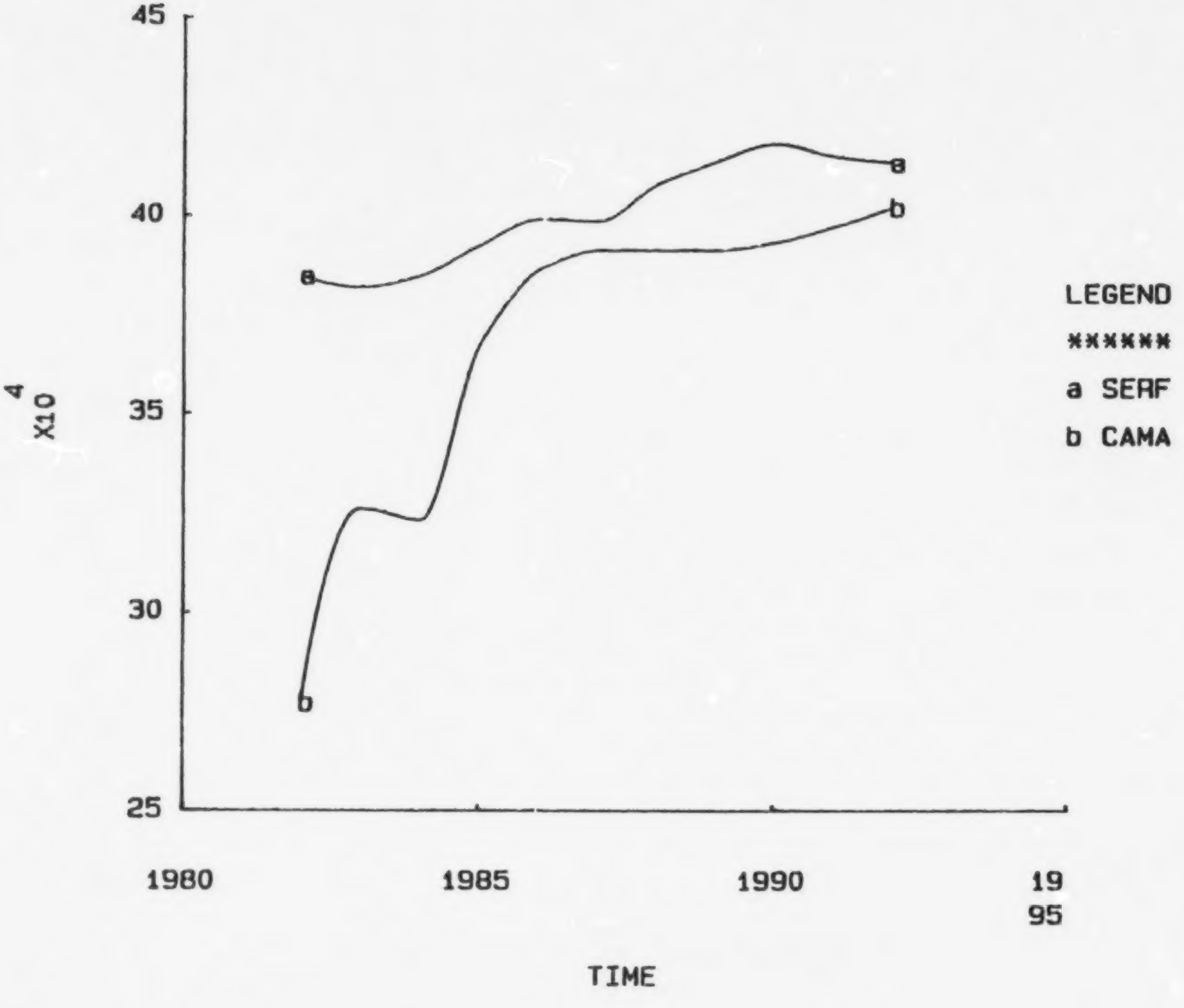
Sales Projections

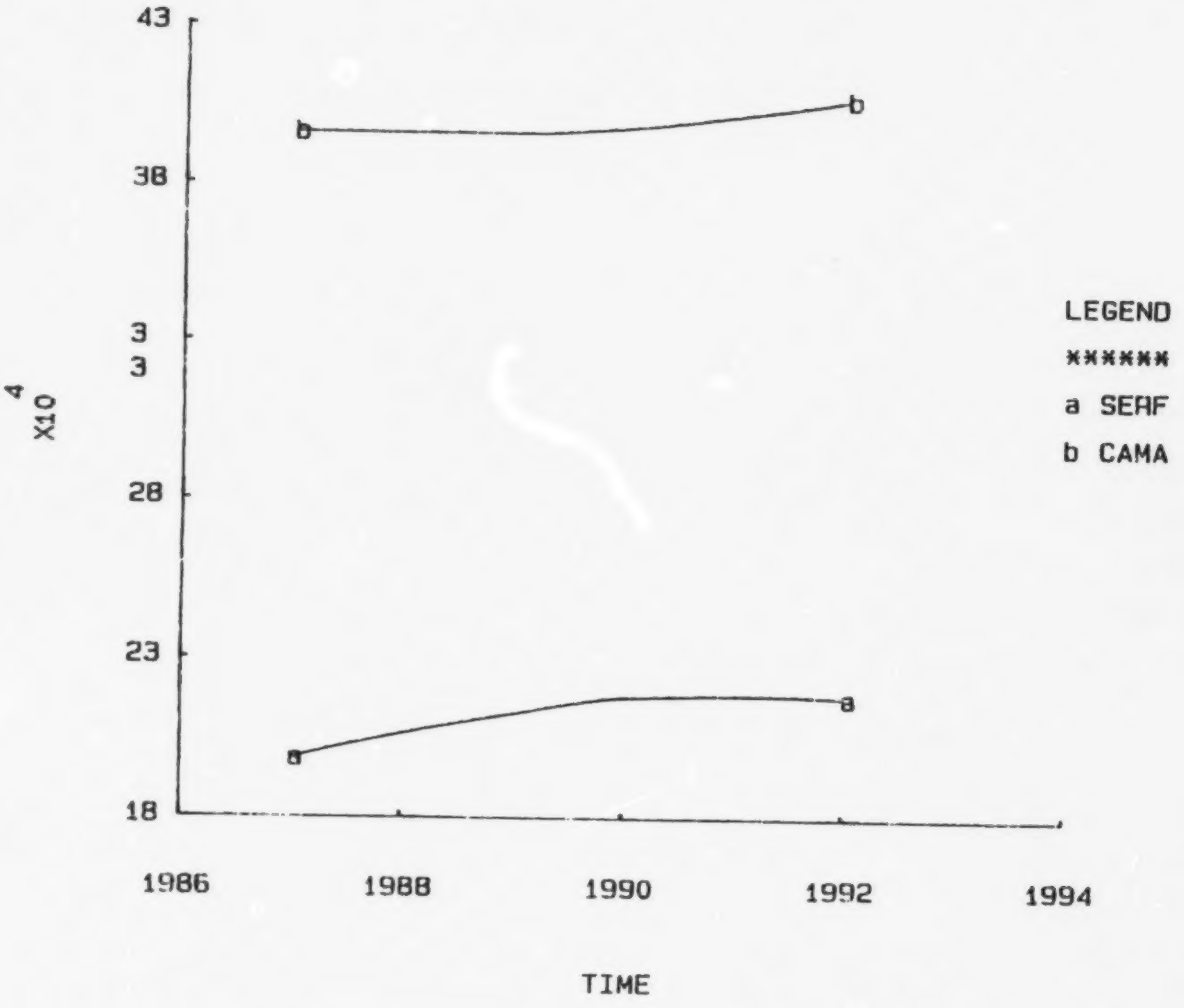
Clothes Washers



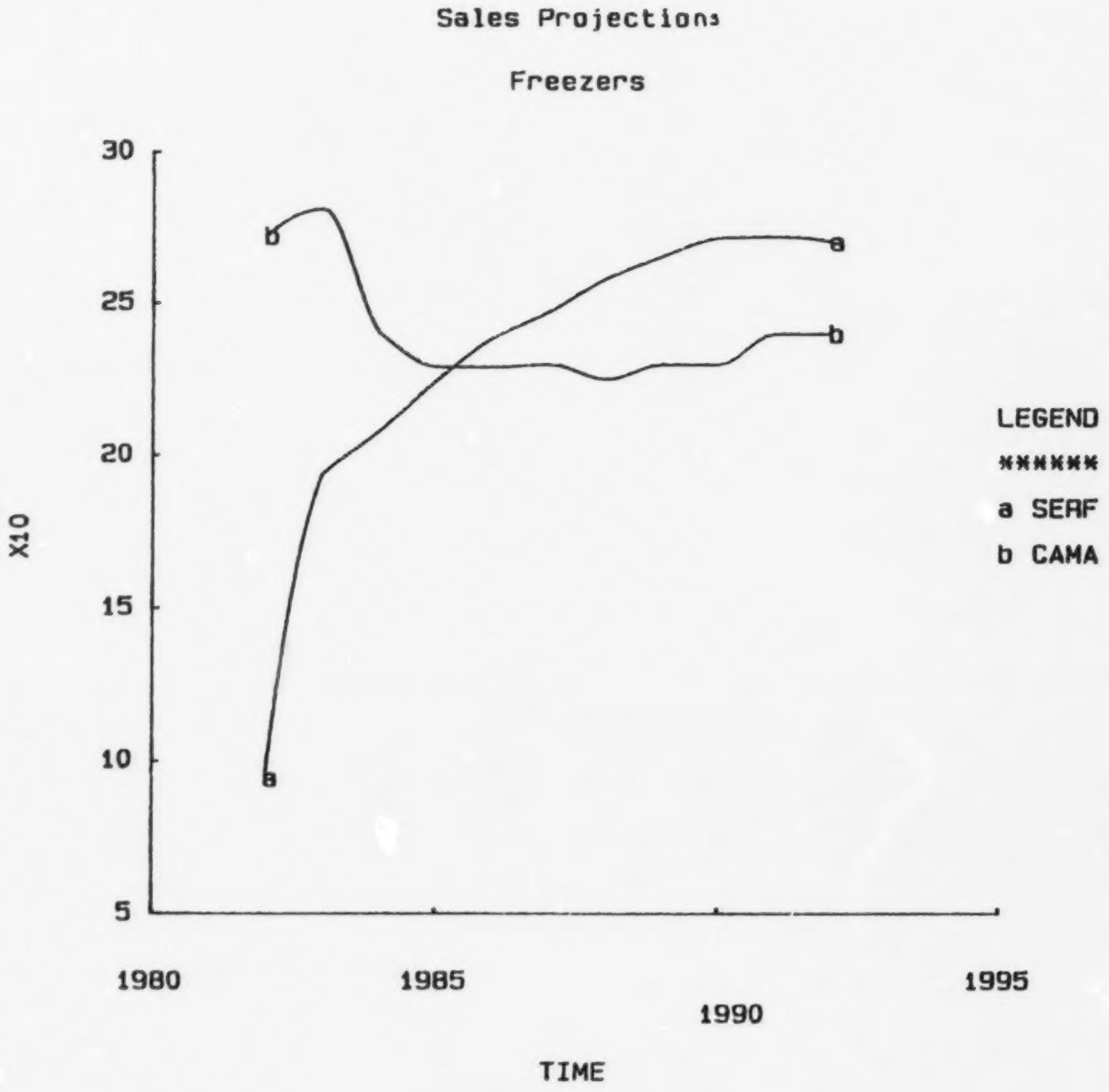
Sales Projections

Clothes Dryers





DISHWASHERS SALES PROJECTIONS



Sales Projections

Freezers

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DESCRIPTION: Appliance sales projections from SERF
                                                                                                DATE: 09-MAR-87 10:39
NAME: A                    UNITS: UNITS                      MAGNITUDE: 10**  0       SLICE:

                1982      1983      1984      1985      1986      1987      1988      1989      1990      1991      1992      1993

EL. RANGE      62276    427314    441710    308279    435101    499697    509007    511148    509796    497830    481666    464169
MICROWAVE     326452    340089    354915    371526   1123505    544076    544476    565523    586530    194297    199970    206187
FRIDGE        529761    532354    541390    553486    560349    635186    644453    646283    645648    634436    619457    603669
WASHER        464075    468448    478631    493409    506182    509901    521959    527928    530353    522651    514928    500100
EL. DRYER     384453    381535    384443    392250    398941    398325    407715    413431    418014    414811    413275    404742
D/W           241963    256924    271584    287716    302344    193536    201345    207803    213082    214023    213192    211694
FREEZER        94444    193847    208082    224538    238486    247283    258165    265521    271658    271955    270247    267928

TOTAL        2103422   2600509   2680754   2631202   3564906   3028001   3057118   3137636   3175079   2750001   2712736   2658488
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DESCRIPTION: Appliance sales projections from SERF
                                                                                                DATE: 09-MAR-87 10
NAME: A                    UNITS: UNITS                      MAGNITUDE: 10**  0       SLICE:

                1994      1995      1996      1997      1998      1999      2000

EL. RANGE     455495    453554    430721    442012    441537    445087    459097
MICROWAVE     219097    236775    254120    266872    284819    304204    330131
FRIDGE        598349    601023    602728    597429    600936    608620    627768
WASHER        492650    491464    490600    486936    490871    499439    517653
EL. DRYER     402393    404130    403432    397437    396973    399959    517653
D/W           213815    218570    222537    223401    227181    232086    412442
FREEZER       271255    278076    282627    281105    282562    283822    289071

TOTAL        2653052   2633570   2706764   2695191   2724879   2773213   2877047
```

APPENDIX C

COMPANY PROFILES - APPLIANCE MANUFACTURERS

COMPANY PROFILE
APPLIANCE EFFICIENCY INFORMATION BASE

Company: Camco Inc.

Head Office Address: 2645 Skymark Ave.
Mississauga, Ontario
L4W 4H2

Tel.No: (416) 629-3000

Products: Refrigerators, Ranges, Dishwashers, Clothes Washers, Clothes Dryers (not freezers); also microwave ovens, portable humidifiers, dehumidifiers, room air conditioners.
Brands: General Electric, Hotpoint, Moffat, McClary, stencil lines

Parent Companies: Canadian General Electric - 51%
GSW Inc.

Foreign Ownership: 53% Canadian
47% U.S.

Plants:

Location	**Products**	**Employees**	**Other**
. Hamilton Plant 175 Longwood Rd. S Hamilton, Ont. L9P 4P8 (416)528-3431	. refrigerators . ranges	500 and over	
. Orangeville Plant 55 Fourth Ave. Orangeville, Ont. (519) 941-5507	. ovens . microwaves . air conditioners	250 to 499	
. London Plant P.O. Box 5040 Stn A London, Ontario N6A 4M1 (519) 434-6831	. refrigerators	100 to 249	Plant to be closed September 1987
. Montreal Plant	. clothes washers . clothes dryers		

CAMCO

Company History: Camco is a 10 year old company formed from a combination of Canadian General Electric Limited, GSW Inc. and Westinghouse Canada Limited.

R&D, Product Development: For the largest appliance manufacturer in Canada, Camco's R & D and product development efforts seem modest. R&D expenditures were $1.8 million in 1984, $0.9 million in 1985 and $1.25 million in 1986. The major new product development in recent years appears to be the solid disk range which is slated for export to the U.S.

Energy Efficiency Position: Camco products do not appear to stand out as either efficient or inefficient in the Canadian market. The Hamilton refrigerator plant has performed a very limited amount of foam insulating for many years and in 1986 this facility was upgraded -- likely in preparation for more efficient refrigerators to challenge the lead taken by the Inglis Project 2000 refrigerators.

Financial Situation: Camco is undoubtedly the largest appliance manufacturer in Canada, with sales that for the first time in 1986 surpassed a half a billion dollars. Total sales in 1986 reached $512 million, 15% higher than in 1985 and market share grew similarly. Profit for 1986 was 4% of sales, 4.2% in 1985 and 3.4% in 1984. Increased export sales have been a key strategy of Camco and grew from $6 million in 1985 to $21 million in 1986. However, this only accounts for 4.1% of sales.

COMPANY PROFILE
APPLIANCE EFFICIENCY INFORMATION BASE

Company: Inglis Ltd.

Head Office Address: 1901 Minnesota Court
Mississauga, Ontario L5N 3A7
Tel.No: (416) 821-6400

Products: Refrigerators, Dishwashers, Ranges, Clothes Dryers, Clothes Washers (not freezers). It also makes trash compactors, food waste disposers, hand mixers and hot water dispensers as a result of its acquisition of Kitchen Aid Canada.
Brands: Inglis, Whirlpool, Admiral, Stencil lines

Parent Companies: Whirlpool Corp, Benton Harbor, Michigan - 51%
Sears, Canada - 20%

Foreign Ownership: 53% U.S.
47% Canadian

Plants:

Location	Products	Employees	Other
. Toronto Plant 14 Strachan Ave. Toronto, Ont. M6K 1W6 (416) 366-7451	. Clothes washers	500 and over	
. Mississauga Plant 501 Lakeshore Rd. E. Mississauga, Ont. L5G 1H9 (416) 278-3372	. Refrigerators	250-499	
. Stoney Creek Plant 400 Green Road Stoney Creek, Ont. L8E 2B4 (416) 664-4466	. Refrigerators	500 and over	Being phased out in 1987
. Montmagny, Quebec	. Electric Ranges . Built in ovens		
. Cambridge, Ont.	. Clothes Dryers . Dishwashers		

INGLIS

Company History: Inglis was started 127 years ago by John Inglis in Guelph, Ontario and in the early years produced fishing tackle, marine boilers, turbines, artillery and wringer washers. In 1946, it signed a licencing agreement with Whirlpool in the U.S. to make wringer washers, then added automatic washers in 1950 and moved into refrigerator and dishwasher production in the 1960s. In 1982, Inglis acquired the assets of the bankrupt Canadian Admiral Corporation and added the Admiral ranges and refrigerators to its product line. In 1985 it added microwave ovens to its production and in 1986 took over the Canadian operations of KitchenAid.

R&D, Product Development: Inglis appears to be the most aggressive of the three major manufacturers in terms of product development. It imports or licences considerable technology from the U.S. and has recently invested substantially in its new Project 2000 refrigerators.

Energy Efficiency Position: The new Inglis-built QL-2000 refrigerators marketed by Sears under the Kenmore stencil line are undoubtedly the most efficient refrigerators built in Canada today. However, in other appliances Inglis does not seem to take a leadership position in energy efficiency.

Financial Situation: Inglis is definitely the number 2 appliance company in Canada, second to CAMCO. Its sales are increasing (6.3% for 1986 over 1985) and it claims to be gaining market share. The company is profitable but profits were reduced in 1986 compared to 1985, resting at 0.6% of sales, down from 2.4% in 1985. This decline in profit is partially attributed to a 25 week strike at the Toronto washer plant in 1986 and the startup costs for the new Project 2000 refrigerators.

COMPANY PROFILE
APPLIANCE EFFICIENCY INFORMATION BASE

Company: WCI Canada Ltd.

Head Office Address: 2233 Argentia Rd.
Mississauga, Ontario
L5W 2X7

Tel.No: (416) 826-9820

Products: Refrigerators, freezers, ranges, dishwashers, clothes washers, clothes dryers
Brand names: Frigidaire, Gibson, Kelvinator, Roy, White-Westinghouse, Arctic Star, stencil lines

Parent Company: 100% owned by WCI of U.S.A. which in turn is now owned by A.B. Electrolux of Sweden

Foreign Ownership: 100% foreign owned (USA)

Plants:

Location	Products	Employees	Other
.Cambridge Plant Franklin Manufacturing Division of WCI 501 Franklin Blvd. Cambridge, Ont. N1R 5W5 (519) 623-1650	. Freezers . Clothes washers . Clothes dryers . Refrigerators	250-to 499	
.L'Assomption Plant HUPP Division of WCI 802 L'Ange Gardien Blvd. L'Assomption, Quebec J0K 1G0 1-800-363-2753	. Refrigerators . Ranges . Dishwashers		

WCI CANADA LTD.

Company Background: W.C.I. Canada Ltd. (White Consolidated Industries) is a private company and a wholly-owned subsidiary of WCI of the U.S.A. which in turn was recently acquired by A.B. Electrolux of Sweden. The company in the U.S. has its origins in the White Sewing Machine Company. In Canada, it acquired the title to the name Westinghouse (but not the manufacturing plant) 10 years ago.

R&D, Product Development: No information is available.

Energy Efficiency Position: The company's products do not appear to be distinctive in the area of energy efficiency. Reportedly, however, the plant at L'Assomption Quebec makes refrigerators for Panasonic which are exported entirely to the U.S. and meet the California efficiency standard.

Financial Situation: WCI is no longer a public company (since 1984) and therefore financial information is not available.

COMPANY PROFILE
APPLIANCE EFFICIENCY INFORMATION BASE

Company: W.C. Wood Co. Ltd.

Head Office Address: 5 Arthur Street S.
P.O. Box 750
Guelph, Ontario N1H 6L9

Tel.No: (519) 821-0900

Products: Freezers, compact refrigerators, dehumidifiers, humidifiers.
Brand Names: Wood, General Electric, Panasonic and stencil lines.

Parent Company: W.C. Wcod Co.

Foreign Ownership: 0% foreign
100% Canadian

Plants:

Location	Products	Employees	Other
. Guelph Plant 5 Arthur Street S. P.O. Box 750 Guelph, Ontario N1H 6L9	all of above	over 500	

W.C. WOOD CO. LTD.

Company Background: W.C. Wood Co. Ltd. is a long established Canadian manufacturer -- primarily of home freezers and is privately owned. The company is the largest freezer manufacturer in Canada with between 40% and 50% share of the domestic market. It also exports about 30% of its production to the U.S. under its own name and others (General Electric, Panasonic, etc.) and is likely number one in world-wide imports of freezers to the U.S.

R&D, Product Development: W.C. Wood appears to be a very active company in terms of R&D and new product development, much if it dedicated to energy efficiency which is a top management policy.

Energy Efficiency Position: W.C. Wood likely produces the world's most energy-efficient (mass produced) freezers. This is done through a combination of increased insulation thickness (and R-values), more efficient (Japanese) compressors and other techniques. In general, Wood produces a standard efficiency freezer (2-1/2" foam insulation) and a high efficiency freezer (3" foam insulation). In the Canadian market, 72% of sales are standard and 28% high efficiency. But in the U.S., 5% are standard and 95% are high efficiency.

Financial Situation: Not known.

COMPANY PROFILE
APPLIANCE EFFICIENCY INFORMATION BASE

Company: General Freezer Ltd.

Head Office Address: P.O. Box 366
9230 Islington Ave.
Woodbridge, Ontario
L4L 1B2

Tel.No: (416) 851-2861

Products: Freezers, dehumidifiers
Brand names: Atlas, General Freezer, Gensave, Zero Freeze, Polaris, Stencil lines

Parent Company: Owned by Canadian Manoir Industries,

Foreign Ownership: 0% foreign
100% Canadian

Plants:

Location	**Products**	**Employees**	**Other**
. Woodbridge Plant P.O. Box 366 9230 Islington Ave. Woodbridge, Ontario L4L 1B2	. Freezers	100 to 249	

GENERAL FREEZER LTD.

Company Background: General Freezer Ltd. is a wholly-owned subsidiary of Canadian Manoir Industries Limited, a Canadian holding company based in Toronto. General Freezer is the second or third largest freezer manufacturer in Canada (neck and neck with WCI) and exports large numbers of units to the U.S. In 1984, it was the largest source of freezer imports to the U.S. (now, likely replaced by W.C. Wood). The company also imports and markets a line of refrigerators from Poland.

R&D, Product Development: No information is available on General Freezers R&D. As part of a larger holding company which also includes other heating and cooling manufacturers (Airco, Duomatic Olsen, Manoir International, Air Heat Supplies) the company benefits from joint R&D efforts.

Energy Efficiency Position: General Freezer makes very efficient freezers which are on par with those of W.C. Wood.

Financial Situation: Separate financial information for General Freezer is not available.

COMPANY PROFILE
APPLIANCE EFFICIENCY INFORMATION BASE

Company: Hoover Canada Ltd.

Head Office Address: 4151 North Service Rd.
Burlington, Ontario
L7R 4A8

Tel.No: (416) 335-3311

Products: Vacuum cleaners, central vacuum systems, clothes washers and compact electric dryers.

Parent Company: The Hoover Company, U.S.A.

Foreign Ownership: 100% foreign owned.

Plants:

Location	Products	Employees	Other
. Burlington Plant 4151 North Service Rd. Burlington, Ont. L7R 4A8	as above	200 to 500 total	only a portion of these are employed in washers and compact dryers

HOOVER

Company Background: Not known.

R&D, Product Development: Not known.

Energy Efficiency Position: Not known.

Financial Situation: Not known.

APPENDIX D

COMPANY PROFILES - HEATING/COOLING EQUIPMENT MANUFACTURERS

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: Brock Engineering Manufacturing Co. Ltd.

Head Office Address: 4305 Iberville Street
Montreal, Quebec
H2H 2L5

Tel. No.: (514)527-8071

Products: gas/electric/oil/solid fuel furnaces

Parent Company: same

Foreign Ownership: 100% Canadian

Plants:

Location	Products	Employees	Other
Montreal, Que.	gas/electric/ oil/ solid-fuel furnaces	50	

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: Carrier Canada Limited

Head Office Address: 8100 Dixie Road
Brampton, Ontario
L6T 2J8

Tel. No.: (416)459-8000

Products: Roof top air-conditioning units
Commercial/Residential air-conditioning units

Parent Company: United Technologies Corp. (U.S.A.)

Foreign Ownership: 100% Foreign

Plants:

Location	Products	Employees	Other
Brampton, Ont.	Air-conditioniers	Over 500	

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: Clare Brothers Ltd.

Head Office Address: 223 King Street
Cambridge, Ontario
N3H 4T5

Tel. No.: (519)653-6245

Products: Air-conditioners
Central high efficiency gas/oil furnaces
Unit heaters

Parent Company: same

Foreign Ownership: 100% Canadian

Plants:

Location	Products	Employees	Other
Cambridge, Ont.	air-conditioners gas/oil furnaces unit heaters	100-249	

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: Climate-Master, Div. of Bow Valley Resource Services Ltd.

Head Office Address: 6130 97th Street
Edmonton, Alberta
T6E 3J4

Tel. No.: (403)436-5924

Products: non-condensing gas fired furnaces
Rooftop Heating/Cooling units

Parent Company: Bow Valley Resource Services Ltd.

Foreign Ownership: 100% Canadian

Plants:

Location	Products	Employees	Other
Edmonton, Alta.			
Toronto, Ont.			

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: Chromalox Canada

Head Office Address: 210 Rexdale Blvd.
Rexdale, Ontario
M9W 1R4

Tel. No.: (416)743-8000

Products: Air-Conditioners
Electric heating boilers
Electric water heaters

Parent Company: Canadian Corporate Management Co.

Foreign Ownership: 100% Canadian

Plants:

Location	Products	Employees	Other
Cambridge, Ont.	metal fabrication		
Kitchener, Ont.	heating cable		
Rexdale, Ont.	heaters	over 1000	
Montreal, Que.	heaters		

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: Duo-Matic Olsen Inc.

Head Office Address: 1969 Leslie St.
Toronto, Ontario
M3B 2M3

Tel. No.: (416)443-1483

Products: gas/oil/electric/solid fuel furnaces

Parent Company: Canadian Manoir Industries Ltd.

Foreign Ownership: 100% Canadian

Plants:

Location	Products	Employees	Other
Tilbury, Ont.	Furnaces	250-299	
Richmond, B.C.	Furnaces		

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: Giant Factories

Head Office Address: 40 Lesage St.
Montreal East, Quebec
H1B 5H3

Tel. No.: (514)645-8893

Products: Electric Water Heaters

Parent Company: ?

Foreign Ownership: 100% Canadian

Plants:

Location	Products	Employees	Other
Montreal, Que.	Electric water heaters		

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: Grimsby Stove & Furnace Ltd.

Head Office Address: 27 John St.
Grimsby, Ontario
L3M 1X4

Tel. No.: (416)945-5446

Products: oil/gas/electric furnaces

Parent Company: same

Foreign Ownership: 100% Canadian

Plants:

Location	Products	Employees	Other
Grimsby, Ont.	oil/gas/electric furnaces	35	

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: GSW Water Products Co.

Head Office Address: 20 Eglinton Ave. West
Box 2047
Toronto, Ontario
M4K 1K8

Tel. No.: (416)489-0640

Products: gas/electric water heaters

Parent Company: Valford Holdings Ltd.

Foreign Ownership: 40.3% Canadian

Plants:

Location	Products	Employees	Other
Fergus, Ont.	gas/electric water heaters	over 500	

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: Keeprite Inc.

Head Office Address: P.O. Box 460
Brantford, Ontario
N3T 5P4

Tel. No.: (519) 753-8471

Products: electric/gas/oil furnaces
air-conditioning equipment

Parent Company: Intercity Gas Corporation

Foreign Ownership: 92.1% Canadian

Plants:

Location	Products	Employees	Other
Montreal, Que.	electric furnaces		
Winnipeg, Man.	commercial furnaces		
Brantford, Ont.	gas furnaces		
	air conditioners	over 500	

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: Kool-Fire Ltd.

Head Office Address: 4425 Kent St. **Tel. No.:** (416)357-0667
Niagara Falls, Ontario
L2H 1J2

Products: Gas condensing furnace/heatpump/air conditioner

Parent Company: same

Foreign Ownership: 100% Canadian

Plants:

Location	Products	Employees	Other
Niagara Falls	gas condensing furnace/heat pump/ air conditioner	12	

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: Lennox Industries (Canada) Inc.

Head Office Address:
400 Glen Norris Rd.
Etobicoke, Ontario
M9C 1H5

Tel. No.: (416)621-9302

Products:
air conditioning units
gas/oil/electric furnaces

Parent Company: Lennox Industries U.S.A.

Foreign Ownership: 99.9% Foreign

Plants:

Location	**Products**	**Employees**	**Other**
Etobicoke, Ont.	air conditioning units gas/oil/electric furnaces	over 500	

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: RHEEM Canada (1984) Inc.

Head Office Address: 128 Barton St. West
P.O. Box 846
Hamilton, Ontario
L8N 3P3

Tel. No.: (416)527-9194

Products: Gas fired boilers
gas/electric water heaters

Parent Company: City Investing Co. (U.S.A.)

Foreign Ownership: 100% Foreign

Plants:

Location	Products	Employees	Other
Hamilton, Ont.	gas fired boilers gas/electric water heaters	over 70	

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: Roberts-Gordon Appliance Corp. Ltd.

Head Office Address: 241 South Service Rd. West **Tel. No.:**(416)945-5403
Grimsby, Ontario
L3M 1Y7

Products: Gas furnaces
Gas heating units

Parent Company: ROKKOR Industries Inc. (U.S.A.)

Foreign Ownership: 100% Foreign

Plants:

Location	Products	Employees	Other
Grimsby, Ont.	gas furnaces gas heating units	30	

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: Trane Canada Inc.

Head Office Address: 401 Horner Ave.
Toronto, Ontario
M8W 2A5

Tel. No.: (416)259-8221

Products:
Radiant heaters
Convection heaters
Hot water heaters
Gas furnaces
Air conditioners

Parent Company: American Standard Inc. (U.S.A.)

Foreign Ownership: 100% Foreign

Plants:

Location	**Products**	**Employees**	**Other**
Toronto, Ont.	radiant/ convection/ hot water heaters	250-499	

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: Westchan Electrical Manufacturing Inc.

Head Office Address: P.O. Box 244
Brantford, Ontario
N3T 5M8

Tel. No.: (519)759-2040

Products: Baseboard Heaters
Wallmount Heaters

Parent Company: ?

Foreign Ownership: ?

Plants:

Location	**Products**	**Employees**	**Other**
Valleyfield, Que.	baseboard heaters		
Brandon, Man.	baseboard heaters		
Brantford, Ont.	baseboard heaters	100-249	
Vancouver, B.C.	wallmount heaters		

COMPANY PROFILE

APPLIANCE EFFICIENCY INFORMATION BASE

Company: York Air Conditioning Ltd.

Head Office Address: 1188 Martingrove Rd.
Rexdale, Ontario
M9N 5W9

Tel. No.: (416)244-6451

Products: gas/electric furnaces

Parent Company: York International Inc. (U.S.A.)

Foreign Ownership: 100% Foreign

Plants:

Location	Products	Employees	Other
Rexdale, Ont.	gas/electric furnaces	65	

APPENDIX E

DATA SETS FROM EFFICIENCY COMPARISONS

MAKE ID	SIZE	KWH/M
ADMIRAL CN681	15.5	165
ADMIRAL CN684	15.5	165
ADMIRAL CN781	17.0	121
ADMIRAL IN681	15.5	165
ADMIRAL IN781	17.0	121
ADMIRAL N681	15.5	165
ADMIRAL N781	17.0	121
ADMIRAL ND781	17.0	121
ADMIRAL NT17B4S	16.5	92
ADMIRAL SCN681	15.5	165
ADMIRAL SCN781	17.0	121
ADMIRAL U681	15.5	165
ADMIRAL U781	17.0	121
ADMIRAL WCN681	15.5	165
ADMIRAL WCN781	17.0	121
AMANA TC18J	17.8	73
AMANA TL18J	17.8	73
AMANA TM16F	16.2	99
AMANA TM16J	15.8	79
AMANA TM16SP	16.2	99
AMANA TM16SPG	15.8	87
AMANA TM18J	17.8	73
AMANA TM18SPG	17.8	90
AMANA TR16J	15.8	79
AMANA TR18J	17.8	73
AMANA TRG16J	15.8	79
AMANA TRG18J	17.8	90
AMANA TRG18SPH	17.8	90
BEAUMARK 377##	17.2	112
BEAUMARK 378##	17.2	112
BRENTWOOD W*F16#1	16.0	130
BRENTWOOD W*F16#1(A)	16.0	152
BRENTWOOD W*F17#1	16.9	115
BRENTWOOD W*F17#4	16.9	121
CALORIC GFD160-1	15.8	79
CALORIC GFD180-1	17.8	73
FASCINATION PRT171	17.2	136
FASCINATION PRT17#	17.2	128
FRIGIDAIRE FT*160M	16.6	103
FRIGIDAIRE FT*173M	17.2	103
FRIGIDAIRE FT*173MS	17.2	103
FRIGIDAIRE TP 188N	17.2	112
FRIGIDAIRE TP160N	16.6	103
FRIGIDAIRE T*173N	17.2	103
GE L17J*E	16.9	121
GE L17J*F	16.9	121
GE L17J*D	16.9	121
GE VL17J*D	16.9	121
GE **L17J*B	16.9	115
GE **L17J*C	16.9	115
GIBSON RF*17K	17.2	112
HITACHI R-842FDU	15.6	110
HOTPOINT RG17#	16.9	115
HOTPOINT RG17#J	16.9	121

MAKE ID	SIZE	KWH/M
HOTPOINT RK17#	16.9	121
HOTPOINT RK17#J	16.9	121
HOTPOINT RT162G	16.0	130
HOTPOINT RT162G(A)	16.0	152
HOTPOINT RT17#	16.9	115
HOTPOINT RT17#G	16.9	121
HOTPOINT RT17#H	16.9	121
HOTPOINT RT17#J	16.9	121
HOTPOINT RT17#K	16.9	121
INGLIS INT72##0	17.0	121
INGLIS INT735#0	17.1	131
INGLIS INT74##0	17.1	131
INGLIS INT75##0	17.0	121
INGLIS INT76##0	17.1	131
INGLIS INT77##0	17.1	131
INGLIS INT78##0	17.1	131
INGLIS LT72##0	17.1	134
INGLIS LT73##0	17.1	134
INGLIS LT74##0	17.1	134
INGLIS LT76##0	17.1	134
INGLIS LT77##0	17.1	134
INGLIS LT78##0	17.1	134
INGLIS NC75##0	17.0	121
KELVINATOR KD186N	17.2	119
KELVINATOR KL183N	17.2	119
KELVINATOR PM16M SERIES	16.6	112
KELVINATOR PM16N SERIES	16.6	112
KELVINATOR X*17M SERIES	17.2	112
KELVINATOR X*17N SERIES	17.2	112
KELVINATOR *17M	17.2	112
KELVINATOR *17N	17.2	112
KELVINATOR KD186N	17.2	119
KELVINATOR KL183N	17.2	119
KENMORE 5076*	16.9	121
KENMORE 51760 SERIES	16.9	121
KENMORE 5276*	16.9	121
KENMORE 5495 SERIES	15.5	165
KENMORE 65950 SERIES	16.0	152
KENMORE 6595#	16.0	152
KENMORE 7390 SERIES	17.1	147
KENMORE 7391 SERIES	17.1	147
KENMORE 7394 SERIES	17.1	147
KENMORE 7395 SERIES	17.0	121
KENMORE 7397 SERIES	17.1	134
KENMORE 7399 SERIES	17.1	134
KENMORE 7490 SERIES	17.1	140
KENMORE 7491 SERIES	17.1	131
KENMORE 7491 SERIES (A)	17.1	140
KENMORE 7494 SERIES	17.1	140
KENMORE 7496 SERIES	17.1	131
KENMORE 7496 SERIES (A)	17.1	134
KENMORE 7497 SERIES	17.1	134
KENMORE 7499 SERIES	17.1	131
KENMORE 7499 SERIES (A)	17.1	134

MAKE ID	SIZE	KWH/M
MCCLARY Y*F16#1	16.0	130
MCCLARY Y*F16#1(A)	16.0	152
MCCLARY Y*F16#4	16.0	152
MCCLARY Y*F16#6	16.0	152
MCCLARY Y*F17#1	16.9	115
MCCLARY Y*F17#4	16.9	121
MCCLARY Y*F17#6	16.9	121
MCCLARY Y-F17*5	16.9	121
MOFFAT M*F16#1(A)	16.0	152
MOFFAT M*F16#3	16.0	130
MOFFAT M*F16#3(A)	16.0	152
MOFFAT M*F16#4	16.0	152
MOFFAT M*F16#6	16.0	152
MOFFAT M*F16#7	16.0	152
MOFFAT M*F16#8	16.0	152
MOFFAT M*F17#1	16.9	115
MOFFAT M*F17#4	16.9	121
MOFFAT M*F17#6	16.9	121
NORGE CNNT178B	16.5	92
VIKING RF16#4	16.6	112
VIKING RF16#7 SERIES	16.6	112
VIKING RF17#4	17.2	112
VIKING RF17#5	17.2	112
VIKING RF17#7 SERIES	17.2	112
WHIRLPOOL EHT74##0	17.1	134
WHIRLPOOL EHT76##0	17.1	134
WHIRLPOOL EHT77##0	17.1	134
WHIRLPOOL EHT78##0	17.1	134
WHIRLPOOL WRT74##0	17.1	131
WHIRLPOOL WRT75##0	17.0	121
WHIRLPOOL WRT76##0	17.1	131
WHIRLPOOL WRT77##0	17.1	131
WHIRLPOOL WRT78##0	17.1	131
WHITE-WEST. W179P	17.2	112
WHITE-WEST. W17#N	17.2	112
WHITE-WEST. WB176P	17.2	112
WHITE-WEST. WC165P	16.6	112
WHITE-WEST. WG172P	17.2	112
WHITE-WEST. WP167N	16.6	112
WHITE-WEST. WP178N	17.2	119
WHITE-WEST. WT17#M	17.2	112
WHITE-WEST. WTP16#M	16.6	112
WHITE-WEST. WT*17#M	17.2	112
WHITE-WEST. W*17#N	17.2	112

REFRIGERATORS - USA

MAKE	MODEL	SIZE	FTC COST	KWH/M
ADMIRAL	ENT17F4	16.5	81	82
ADMIRAL	ENT17F4L	16.5	81	82
ADMIRAL	BNT17B4V	16.5	90	91
ADMIRAL	BINT17B4V	16.5	90	91
ADMIRAL	NT17D4V	16.5	90	91
ADMIRAL	NT17B8V	16.5	90	91
ADMIRAL	NT17B6V	16.6	90	91
AMANA	TMI16H	15.8	79	80
AMANA	TR16H	15.8	79	80
AMANA	TM18H	17.7	79	80
AMANA	TR18H	17.8	79	80
AMANA	TRG18SPH	17.8	79	80
AMANA	TLI18H	17.8	79	80
AMANA	TC18H	17.8	79	80
AMANA	TL18H	17.8	79	80
CALORIC	GFS160-1*1	16.0	78	79
CALORIC	GFD170-1*1	16.6	78	79
CORONADO	RE1-48*0	16.6	78	79
CROSLEY	CNT17L5V	16.5	90	91
CROSLEY	CNT17L7V	16.6	90	91
FRIGIDAIRE	FPD-16TC*0	16.0	69	70
FRIGIDAIRE	FPD-16TLC*0	16.0	69	70
FRIGIDAIRE	FPD-16TIC*0	16.0	69	70
FRIGIDAIRE	FPD-16TILC*0	16.0	69	70
FRIGIDAIRE	FPI-16TC*0	16.0	69	70
FRIGIDAIRE	FPE-16TC*0	16.0	69	70
GAFFERS&SATTLER	E17*1*NTP	16.5	90	91
G.E.	TBF16SG	15.5	98	99
G.E.	TBF16VG	15.5	98	99
G.E.	TBF16AG	15.5	98	99
G.E.	TBF16G	15.5	98	99
G.E.	TBF16DG	15.5	98	99
G.E.	TBF16ZG	15.5	98	99
G.E.	TBX18LH	17.7	82	83
G.E.	TBX18AH	17.7	82	83
G.E.	TBX18VH	17.7	82	83
G.E.	TBX18PH	17.7	82	83
G.E.	TBX18SH	17.7	82	83
G.E.	TBX18BH	17.7	82	83
G.E.	TBX18DH	17.7	82	83
G.E.	TBX18CH	17.7	78	79
G.E.	TBX18KH	17.7	82	83
G.E.	TBX18ZH	17.7	82	83
GIBSON	RT16F3*MGC	16.0	69	70
GIBSON	RD16F3*MGC	16.0	69	70
GIBSON	RT17F7*SGA	16.6	78	79
GIBSON	RD17F7*SGA	16.6	78	79
GIBSON	RT17F7*P3A	16.6	69	70
GIBSON	RT17F2*T3A	16.6	78	79
GIBSON	RD17F2*T3A	16.6	78	79
GIBSON	RD17F7*P3A	16.6	69	70
GIBSON	RT17F3*SGA	17.0	84	85
GIBSON	RDT17F3*SGA	17.0	84	85
GIBSON	RT17F3*MGG	17.0	84	85

MAKE	MODEL	SIZE	FTC COST	KWH/M
GIBSON	RD17F3*MGG	17.0	84	85
GIBSON	RT17F3*RGB	17.0	77	78
GIBSON	RD17F3*RGB	17.0	77	78
GIBSON	RT17F3*RGA	17.0	77	78
GIBSON	RD17F3*RGA	17.0	77	78
GIBSON	RT17F6*SGA	17.0	84	85
GIBSON	RD17F6*SGA	17.0	84	85
GIBSON	RT17F6*SGB	17.0	84	85
GIBSON	RD17F6*SGB	17.0	84	85
GIBSON	RT17F9*SGA	17.0	84	85
GIBSON	RD17F9*SGA	17.0	84	85
GIBSON	RT17F8*SGA	17.0	84	85
GIBSON	RT17F8*SGA	17.0	84	85
GIBSON	RT17F8*RGA	17.0	77	78
GIBSON	RD17F8*RGA	17.0	77	78
HOTPOINT	CTF16AG	15.5	98	99
HOTPOINT	CTF16CG	15.5	98	99
HOTPOINT	CTF16EG	15.5	98	99
HOTPOINT	CTF16GG	15.5	98	99
HOTPOINT	CTX18LH	17.7	82	83
HOTPOINT	CTX18EH	17.7	82	83
HOTPOINT	CTX18HH	17.7	78	79
HOTPOINT	CTX18GH	17.7	82	83
HOTPOINT	CTX18CH	17.7	82	83
KELVINATOR	TPK160AN4*	16.0	95	96
KELVINATOR	TPK160BN2*	16.0	78	79
KELVINATOR	TPK160ZN0*	16.0	69	70
KELVINATOR	TPI160AN4*	16.0	95	96
KELVINATOR	TMK160AN6*	16.0	78	79
KELVINATOR	TUK160AN6*	16.0	78	79
KELVINATOR	TSK160AN4*	16.0	78	79
KELVINATOR	TSI160AN4*	16.0	78	79
KELVINATOR	TGK160AN4*	16.0	78	79
KELVINATOR	TGI160AN4*	16.0	78	79
KENMORE	86763*0	16.2	77	78
KENMORE	87763*0	16.2	77	78
KENMORE	86663*0	16.3	74	75
KENMORE	87663*0	16.3	74	75
KENMORE	87563*0	16.3	76	77
KENMORE	86464*0	16.3	82	83
KENMORE	87464*0	16.3	82	83
KENMORE	83677*0	16.6	78	79
KENMORE	83670*0	16.6	78	79
KENMORE	87572*2	16.6	78	79
KENMORE	86572*1	16.6	78	79
KENMORE	86377*0	17.1	72	73
KENMORE	87485*0	17.7	88	89
KENMORE	86485*0	17.7	88	89
KENMORE	86486*0	17.7	88	89
KENMORE	87486*0	17.7	88	89
MAGIC CHEF	RB17E*1AF	16.5	90	91
MAGIC CHEF	RB17E*1A	16.5	90	91
MAGIC CHEF	RB17E*3A	16.5	90	91
MAGIC CHEF	RNB17E*3A	16.5	90	91

MAKE	MODEL	SIZE	FTC COST	KWH/M
MAGIC CHEF	RB17E*2A	16.6	90	91
MAGIC CHEF	RB17E*2AF	16.6	90	91
MARQUETTE	175F	16.6	78	79
MONTGOMERY WARD	HMG17354	16.4	90	91
MONTGOMERY WARD	HMG17754	16.6	90	91
NORGE	NNT178BV	16.5	90	91
O'KEEFE & MERRITT	95-1766-00	16.6	90	91
O'KEEFE & MERRITT	95-1766-23	16.6	90	91
O'KEEFE & MERRITT	95-1766-25	16.6	90	91
O'KEEFE & MERRITT	95-1766-57	16.6	90	91
O'KEEFE & MERRITT	95-1766-66	16.6	90	91
PANASONIC	NR1615X	15.6	91	92
PANASONIC	NR1605X	15.6	91	92
PANASONIC	NR1815X	17.5	93	94
PANASONIC	NR1805X	17.5	93	94
PANASONIC	NR1807X	17.5	93	94
PANASONIC	NR1817X	17.5	93	94
PANASONIC	NR1806X	17.5	93	94
PANASONIC	NR1816X	17.5	93	94
PHILCO	RD16K7*MR2	16.0	95	96
ROPER	8617-*0A	16.6	78	79
ROPER	8616-*0A	16.6	78	79
TAPPAN	95-1776-00	16.6	90	91
TAPPAN	95-1776-23	16.6	90	91
TAPPAN	95-1776-45	16.6	90	91
TAPPAN	95-1776-57	16.6	90	91
TAPPAN	95-1776-66	16.6	90	91
TEMPMASTER	86-133**	16.6	83	84
VIVA	VNT17	16.5	104	105
WHIRLPOOL	ET16XK1M	16.0	76	77
WHIRLPOOL	ET16JKXR	16.3	74	75
WHIRLPOOL	ET16JMXR	16.3	74	75
WHIRLPOOL	ET16JKXR*1	16.3	77	78
WHIRLPOOL	ET16JMXR*1	16.3	77	78
WHIRLPOOL	ET16TK1M	16.3	76	77
WHIRLPOOL	ET16EPIP	16.3	77	78
WHIRLPOOL	ET16AKXR	16.3	74	75
WHIRLPOOL	ET16AKXR*1	16.3	77	78
WHIRLPOOL	ET16EKIP	16.3	77	78
WHIRLPOOL	EHT171TK	17.0	110	111
WHIRLPOOL	ET17HKXM	17.2	72	73
WHIRLPOOL	ET17HKXR	17.2	61	61
WHIRLPOOL	ET17HKXP	17.2	61	61
WHIRLPOOL	ET18ZKXM	17.6	88	89
WHIRLPOOL	EHT183VK	17.6	88	89
WHIRLPOOL	ET18MK2L	17.6	88	89
WHITE-WESTINGHOUSE	RT163G*1	16.0	78	79
WHITE-WESTINGHOUSE	RT174Z*0	16.6	69	70
WHITE-WESTINGHOUSE	RT171G*0	17.0	106	107
WHITE-WESTINGHOUSE	RT173G*2	17.0	84	85
WHITE-WESTINGHOUSE	RT173H*0	17.0	77	78
WHITE-WESTINGHOUSE	RT175G*0	17.0	84	85
WHITE-WESTINGHOUSE	RT170G*2	17.0	84	85
WHITE-WESTINGHOUSE	RT177G*0	17.0	84	85

MAKE	MODEL	SIZE	FTC COST	KWH/M
WHITE-WESTINGHOUSE	RT177H*0	17.0	77	78
WHITE-WESTINGHOUSE	RT178G*2	17.0	84	85
WHITE-WESTINGHOUSE	RT176G*2	17.0	84	85
WHITE-WESTINGHOUSE	RT176G*4	17.0	84	85
WHITE-WESTINGHOUSE	RT176H*0	17.0	77	78
WHITE-WESTINGHOUSE	RT179H*1	17.0	84	85

FREEZERS 283-396L - CANADA

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
AMANA	C10B	285.0	69
AMANA	CD10B	285.0	69
ATLAS	GC12	326.0	51
ATLAS	G12	334.0	77
ATLAS	GN13	371.0	55
BEAUMARK	8123#	343.0	56
BEAUMARK	8122#	343.0	56
BRENTWOOD	GC12	326.0	51
BRENTWOOD	G12	334.0	77
CORONADO	RE3-1256	350.0	49
DANBY	D1005	286.0	51
DANBY	D1200	350.0	57
FASCINATION	PCH12	334.0	77
FRIGIDAIRE	CA12J	343.0	56
FRIGIDAIRE	CD12J	343.0	56
GENERAL FREEZER	G12	334.0	77
GENERAL FREEZER	GN13	371.0	55
GENSAVE	GN13	371.0	55
GIBSON	CA12J	343.0	56
GIBSON	CD12J	343.0	56
IMPERIAL	WF12C	343.0	56
KELVINATOR	CA12J	343.0	56
KELVINATOR	CD12J	343.0	56
KENMORE	47110	286.0	51
KENMORE	111#	314.0	77
KENMORE	8125 SERIES	350.0	49
KENMORE	4712 SERIES	350.0	49
KENMORE	412#	350.0	57
KENMORE	47210	350.0	57
KENMORE	4212 SERIES	350.0	49
KENMORE	47280	350.0	44
KENMORE	4512 SERIES	350.0	49
KENMORE	4312	350.0	49
KENMORE	47240	350.0	49
KENMORE	47220	350.0	57
KENMORE	22##	360.0	68
KENMORE	25##	360.0	68
KENMORE	2413 SERIES	360.0	68
KENMORE	214#	390.0	72
K-MART	GC12	326.0	51
K-MART	G12	334.0	77
LEONARD	CD12J	343.0	56
LEONARD	CD12H-1	343.0	56
LEONARD	CA12J	343.0	56
ROY	CA12H-1	343.0	56
ROY	CA12J	343.0	56
ROY	CD12J	343.0	56
ROY	CD12H-1	343.0	56
VIKING	1FC12##	343.0	56
VIKING	2FC12##	343.0	56
VISCOUNT	GC12	326.0	51
VISCOUNT	LHW12	334.0	77
VISCOUNT	VHE12-5	343.0	56
VISCOUNT	VHE12-6	343.0	56

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
WHITE-WESTINGHOUSE	CA12J	343.0	56
WHITE-WESTINGHOUSE	CA12H-1	343.0	56
WHITE-WESTINGHOUSE	AD12H-1	343.0	56
WHITE-WESTINGHOUSE	CD12J	343.0	56
WOOD'S	WU29	285.0	62
WOOD'S	WC28	286.0	51
WOOD'S	WU35	345.0	69
WOOD'S	WC35	350.0	57
WOOD'S	WE35	350.0	49
ZENITH	GC12	326.0	51
ZENITH	G12	334.0	77
ZERO FREEZE	GC12	326.0	51
ZERO FREEZE	G12	334.0	77

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
AMANA	C15SPB	425.0	95
AMANA	C15B-2	425.0	88
AMANA	C15B	425.0	95
AMANA	C15B-1	425.0	87
ATLAS	G15	424.0	84
ATLAS	G18	509.0	115
BEAUMARK	8152#	428.0	64
BRENTWOOD	G15	424.0	84
BRENTWOOD	G18	509.0	115
CORONADO	RE3-1330	474.0	51
DANBY	D1500	424.0	54
DANBY	D1800	509.0	61
FASCINATION	PCH15	424.0	84
FASCINATION	PCH18	509.0	115
FRIGIDAIRE	CA15J	428.0	64
GENERAL FREEZER	G15	424.0	84
GENERAL FREEZER	GC15-1	425.0	55
GENERAL FREEZER	G18	509.0	115
GIBSON	CA15J	428.0	64
KELVINATOR	CA15J	428.0	64
KENMORE	47520	424.0	54
KENMORE	3915 SERIES	425.0	59
KENMORE	415#	425.0	59
KENMORE	115#	430.0	93
KENMORE	2316 SERIES	450.0	79
KENMORE	2616 SERIES	450.0	79
KENMORE	4317 SERIES	460.0	56
KENMORE	4117 SERIES	460.0	56
KENMORE	4610 SERIES	460.0	56
KENMORE	4617 SERIES	460.0	56
KENMORE	8167 SERIES	460.0	56
KENMORE	47740	474.0	51
K-MART	G15	424.0	84
K-MART	G18	509.0	115
LEONARD	CA15J	428.0	64
ROY	CA15H-1	428.0	64
ROY	CA15J	428.0	64
VIKING	2FC15##	428.0	64
VIKING	1FC15##	428.0	64
VISCOUNT	LHW15	424.0	84
VISCOUNT	VHE15S-2	428.0	64
VISCOUNT	VHE15S-3	428.0	64
VISCOUNT	LHW18	509.0	115
WHITE-WESTINGHOUSE	CA15J	428.0	64
WHITE-WESTINGHOUSE	CA15H-1	428.0	64
WOOD'S	WC42	424.0	54
WOOD'S	WE46	474.0	51
ZENITH	G15	424.0	84
ZENITH	G18	509.0	115
ZERO FREEZE	G15	424.0	84
ZERO FREEZE	G18	509.0	115

PROJECT 7005

FREEZERS 10-14 CU. FT. - USA

MANUFACTURER/NAME	MODEL NUMBER	SIZE	FTC	KWH/M
ADMIRAL	C10D	10.2	45	48
AMANA	C10B	10.0	40	43
CORONADO	RE4-9080D	10.1	43	46
CROSLEY	C10D	10.2	45	48
FREEZE-MASTER	C10D	10.2	45	48
GENERAL	GC12-1	11.6	36	38
GENERAL	GC12	11.6	33	35
GENERAL ELECTRIC	CB10DF	10.1	43	46
GENERAL ELECTRIC	CB10DJ	10.1	33	35
GENSAVE	GN13	13.1	36	38
GIBSON	FH10M4WTFA	10.1	43	46
HOLIDAY	C10D	10.2	45	48
HOTPOINT	FH10CF	10.1	43	46
HOTPOINT	FH10CJ	10.1	33	35
IMPERIAL	C10D	10.2	45	48
KELVINATOR	CFS101DMOW	10.1	43	46
KENMORE	816221	12.0	47	50
KENMORE	816228	12.0	47	50
MARQUETTE	HT10	10.1	43	46
MONTGOMERY WARD	FF80846-7	10.3	43	46
NATIONAL	C10D	10.2	45	48
PANASONIC	NR-1305 FC	12.4	32	34
UNIVERSAL	C10D	10.2	45	48
WHIRLPOOL	EH120CXP	12.1	47	50
WHITE-WESTINGHOUSE	FC105JTD1	10.1	43	46
WOOD'S	OC35	12.4	37	39
WOOD'S	OC28	10.1	33	35

MANUFACTURER/NAME	MODEL NUMBER	SIZE	FTC	KWH/M
ADMIRAL	C15DAB	15.2	58	62
ADMIRAL	CA5D	15.2	58	62
AMANA	C15SPB	15.0	55	59
AMANA	C15B	15.0	55	59
CORONADO	RE4-8153B	15.6	63	67
CORONADO	RE4-8057J	15.6	63	67
CROSLEY	C15DAB	15.2	58	62
FREEZE MASTER	C15DAB	15.2	58	62
FREEZE MASTER	C15D	15.2	58	62
FRIGIDAIRE	CF-16K-W*3	15.6	63	67
FRIGIDAIRE	CFS-16M-W*3	15.7	63	67
GENERAL	GC15	14.8	41	44
GENERAL	GC18	17.6	48	51
GENERAL ELECTRIC	CB15DJ	15.0	35	37
GENERAL ELECTRIC	CB15DF	15.6	63	67
GIBSON	FH16M2WSFC	15.7	63	67
HOLIDAY	C15D	15.2	58	62
HOLIDAY	C15DAB	15.2	58	62
HOTPOINT	FH15CJ	15.0	35	37
HOTPOINT	FH15CF	15.6	63	67
IMPERIAL	C15DAB	15.2	58	62
IMPERIAL	C15D	15.2	58	62
IMPERIAL	HF16CA4	15.6	63	67
KELVINATOR	HFP156AM3W	15.7	63	67
KELVINATOR	HFS156SM5W	15.7	63	67
KENMORE	813151	15.1	55	59
KENMORE	816551	15.1	50	53
KENMORE	816258	15.1	50	53
KENMORE	816558	15.1	50	53
KENMORE	816251	15.1	50	53
MAGIC CHEF	C15DAB	15.2	58	62
MAGIC CHEF	C15D	15.2	58	62
MARQUETTE	H15	15.6	63	67
MONTGOMERY WARD	FFT85196-0	15.7	63	67
NATIONAL	C15DAB	15.2	58	62
NATIONAL	C15D	15.2	58	62
PANASONIC	NR-1705FC	16.8	38	40
UNIVERSAL	C15DAB	15.2	58	62
UNIVERSAL	C15D	15.2	58	62
VIVA	VCF15	15.3	66	70
WHIRLPOOL	EH1500XP	15.2	55	59
WHIRLPOOL	EH150CXP	15.2	55	59
WHIRLPOOL	EH15EFXP	15.2	55	59
WHIRLPOOL	EH150FXP	15.2	55	59
WHITE-WESTINGHOUSE	FC161DTW5	15.7	63	67
WHITE-WESTINGHOUSE	FC164DTW5	15.7	63	67
WOOD'S	OC42	15.1	35	37

DISHWASHERS - CANADA

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
ADMIRAL	DU0416#1	38.0	99
ADMIRAL	DU0418#1	38.0	99
ADMIRAL	DC0414#0	38.0	99
ADMIRAL	DU0415#1	38.0	99
ADMIRAL	DC0415#1	38.0	99
ADMIRAL	DU0416#2	38.0	99
ADMIRAL	DU0416#0	38.0	99
ADMIRAL	DU0418#2	38.0	99
ADMIRAL	DU0415#0	38.0	99
ADMIRAL	DC0416#2	38.0	99
ADMIRAL	DC0418#0	38.0	99
ADMIRAL	DC0418#2	38.0	99
ADMIRAL	DU0414#0	38.0	99
ADMIRAL	DC0416#1	38.0	99
ADMIRAL	DU0414#1	38.0	99
ADMIRAL	DU0418#0	38.0	99
ADMIRAL	DC0418#1	38.0	99
ADMIRAL	DC0416#0	38.0	99
BEAUMARK	4029#	29.0	86
BEAUMARK	41260	29.0	86
BEAUMARK	4021#	29.0	84
BEAUMARK	4121#	29.0	84
BEAUMARK	4129#	29.0	86
BEAUMARK	4125#	29.0	84
BEAUMARK	40260	29.0	86
BEAUMARK	4022#	29.0	84
BEAUMARK	4025#	29.0	84
BEAUMARK	4123#	29.0	84
BEAUMARK	4023#	29.0	84
BEAUMARK	4159#	34.3	93
BEAUMARK	4149#	38.7	110
BEAUMARK	4122#	29.0	84
DANBY	C*220E	29.0	84
DANBY	C*200E	29.0	84
DANBY	C*250E	29.0	86
DANBY	C*210E	29.0	84
EATON	ED2*400E	29.0	84
FRIGIDAIRE	FME73K	29.5	85
FRIGIDAIRE	FBE103K	29.5	83
FRIGIDAIRE	FBC43K	29.5	85
FRIGIDAIRE	FME73J	29.5	85
FRIGIDAIRE	FBE73K	29.5	85
FRIGIDAIRE	FBE73J	29.5	85
FRIGIDAIRE	FBB73J	29.5	85
FRIGIDAIRE	FBE103J	29.5	83
FRIGIDAIRE	FBC43J	29.5	85
FRIGIDAIRE	FMC43J	29.5	85
FRIGIDAIRE	FMC43K	29.5	85
FRIGIDAIRE	FBE200K	33.2	92
GENERAL ELECTRIC	GM*950X	26.6	84
GENERAL ELECTRIC	GR*530X	29.0	84
GENERAL ELECTRIC	VR*501X	29.0	84
GENERAL ELECTRIC	GM*680E	29.0	84
GENERAL ELECTRIC	GR*810X	29.0	84

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
GENERAL ELECTRIC	GM*930X	29.0	84
GENERAL ELECTRIC	GM*920X	29.0	84
GENERAL ELECTRIC	GM*670X	29.0	84
GENERAL ELECTRIC	GM*670E	29.0	84
GENERAL ELECTRIC	VR*535X	29.0	84
GENERAL ELECTRIC	GR*680X	29.0	84
GENERAL ELECTRIC	GM*910E	29.0	84
GENERAL ELECTRIC	SM*950V	33.0	98
GENERAL ELECTRIC	SM*955V	33.0	98
GENERAL ELECTRIC	SM*930V	33.0	98
GENERAL ELECTRIC	GS*2800E	34.0	90
GENERAL ELECTRIC	GS*2500X	34.3	93
GIBSON	G*781H	29.5	85
GIBSON	G*781J	29.5	85
GIBSON	G*561J	29.5	85
GIBSON	G*561H	29.5	85
HOTPOINT	S*610E	29.0	86
HOTPOINT	S*518E	29.0	84
HOTPOINT	S*212E	29.0	84
HOTPOINT	S*522D	29.0	84
HOTPOINT	S*528E	29.0	84
HOTPOINT	S*512E	29.0	84
HOTPOINT	S*410E	29.0	84
HOTPOINT	S*810E	29.0	84
HOTPOINT	S*420E	29.0	84
HOTPOINT	S*F2100E	34.0	90
HOTPOINT	S*2000E	34.3	93
INGLIS	PD285#0	31.6	85
INGLIS	PF27##0	31.6	85
INGLIS	PD28##0	31.6	85
INGLIS	PD38##0	31.6	85
INGLIS	PD37##1	31.6	85
INGLIS	PD39##0	31.6	85
INGLIS	PD29##0	31.6	85
INGLIS	ND27##0	38.0	99
INGLIS	ND37##0	38.0	99
INGLIS	PD36##0	38.0	99
INGLIS	ND38##0	38.0	99
INGLIS	PD36##1	38.0	99
INGLIS	ND391#0	38.0	99
INGLIS	ND24##0	38.0	99
INGLIS	PD33##0	38.0	99
INGLIS	ND26##0	38.0	99
INGLIS	ND28##0	38.0	99
INGLIS	PD26##1	38.0	99
INGLIS	ND36##0	38.0	99
INGLIS	PD23##0	38.0	99
INGLIS	PD23##1	38.0	99
INGLIS	PD33##1	38.0	99
INGLIS	ND34##0	38.0	99
INGLIS	PD26##0	38.0	99
JENN-AIR	D*450C	33.9	87
JENN-AIR	D*490C	33.9	87
JENN-AIR	D*470C	33.9	87

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
KELVINATOR	*8K	29.5	85
KELVINATOR	*8J	29.5	85
KELVINATOR	*8H	29.5	85
KELVINATOR	US1K	33.2	92
KENMORE	743700	31.6	85
KENMORE	744411 SERIES	38.0	99
KENMORE	7232 SERIES	38.0	99
KENMORE	74330 SERIES	38.0	99
KENMORE	7233 SERIES	38.0	99
KENMORE	74341 SERIES	38.0	99
KENMORE	7332 SERIES	38.0	99
KENMORE	74351 SERIES	38.0	99
KENMORE	7334 SERIES	38.0	99
KENMORE	744211 SERIES	38.0	99
KENMORE	7335 SERIES	38.0	99
KENMORE	74441 SERIES	38.0	99
KENMORE	7342 SERIES	38.0	99
KENMORE	74451 SERIES	38.0	99
KENMORE	7344 SERIES	38.0	99
KENMORE	7434 SERIES	38.0	99
KENMORE	7345 SERIES	38.0	99
KENMORE	74421 SERIES	38.0	99
KENMORE	7432 SERIES	38.0	99
KENMORE	74321 SERIES	38.0	99
KENMORE	4435 SERIES	38.0	99
KENMORE	7435 SERIES	38.0	99
KENMORE	744511 SERIES	38.0	99
KENMORE	74431 SERIES	38.0	99
KENMORE	7231 SERIES	38.0	99
KITCHENAID	KDS-20	30.3	89
KITCHENAID	KDC-20	30.3	94
KITCHENAID	KDI-20	30.3	94
KITCHENAID	KDSS-20C	30.3	89
KITCHENAID	KDI-60	30.3	94
KITCHENAID	KDC-20C	30.3	94
KITCHENAID	KDS-20C	30.3	89
KITCHENAID	KDI-20C	30.3	94
KITCHENAID	KDS-60	30.3	89
KITCHENAID	KDI-60C	30.3	94
KITCHENAID	KDS-40C	30.3	89
KITCHENAID	KDI=61	30.3	94
KITCHENAID	KDS-60C	30.3	89
KITCHENAID	KDI-40C	30.3	94
KITCHENAID	KDC-40C	30.3	94
KITCHENAID	KDC-60C	30.3	94
KITCHENAID	KDI-21AC	36.0	100
KITCHENAID	KDC-21AC	36.3	104
KITCHENAID	KDC-61AC	36.3	104
KITCHENAID	KDP-21C	37.0	103
KITCHENAID	KDP-21	37.0	103
KITCHENAID	KDSC-21C	37.0	103
KITCHENAID	KDS-21	37.0	103
KITCHENAID	KDSS-21C	37.0	103
KITCHENAID	KDSM-21C	37.0	103

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
KITCHENAID	KDSS-21AC	37.0	103
KITCHENAID	KDS-21C	37.0	103
MAYTAG	W*701	33.9	87
MAYTAG	W*181	33.9	87
MAYTAG	W*501	33.9	87
MAYTAG	W*301	33.9	87
MAYTAG	W*901	33.9	87
MCCLARY	YD*1131A	29.0	84
MCCLARY	YD*1261A	29.0	86
MOFFAT	MD*1370A	29.0	86
MOFFAT	MD*1250A	29.0	84
MOFFAT	MD*1372E	29.0	86
MOFFAT	MD*1260E	29.0	86
MOFFAT	MD*1130A	29.0	84
ROY	G*561J	29.5	85
ROY	G*781H	29.5	85
ROY	G*781J	29.5	85
ROY	G*561K	29.5	85
ROY	G*561H	29.5	85
VIKING	DC624	29.5	85
VIKING	DC622	29.5	85
VIKING	DC832	29.5	85
VIKING	DC834	29.5	85
VIKING	DU652	29.5	85
VIKING	DU864	29.5	85
VIKING	DU862	29.5	85
VIKING	DU654	29.5	85
VIKING	DCTP4	33.2	92
VIKING	DUTP2	33.2	92
VIKING	DUTP4	33.2	92
VIKING	DCTP2	33.2	92
WHIRLPOOL	TJF28##0	31.6	85
WHIRLPOOL	TJU38##0	31.6	85
WHIRLPOOL	SJU36##0	38.0	99
WHIRLPOOL	SJU37##0	38.0	99
WHIRLPOOL	SJU34##0	38.0	99
WHIRLPOOL	TJ32##0	38.0	99
WHIRLPOOL	TJU35##1	38.0	99
WHIRLPOOL	TJU37##0	38.0	99
WHIRLPOOL	SJF24##0	38.0	99
WHIRLPOOL	TJU32##1	38.0	99
WHIRLPOOL	SJF27##0	38.0	99
WHIRLPOOL	TJU35##0	38.0	99
WHIRLPOOL	TJU37##1	38.0	99
WHIRLPOOL	TJF27##1	38.0	99
WHIRLPOOL	SJF26##0	38.0	99
WHIRLPOOL	TJF25##1	38.0	99
WHITE-WESTINGHOUSE	W*610J	29.5	85
WHITE-WESTINGHOUSE	W*810H	29.5	85
WHITE-WESTINGHOUSE	W*810J	29.5	85
WHITE-WESTINGHOUSE	W*610K	29.5	85
WHITE-WESTINGHOUSE	W*610H	29.5	85
WHITE-WESTINGHOUSE	WU990K	33.2	92

PROJECT 7005

DISHWASHERS - USA

MANUFACTURER/NAME	MODEL NUMBER	KWH/YR	KWH/M
BROWN STOVE WORKS	BSW1100	955	79
BROWN STOVE WORKS	BSW900	955	79
CALORIC	DUS20*-19	955	79
CALORIC	DCS211-1*	955	79
CALORIC	DUS202-1W	955	79
CALORIC	DCS215-1*	955	79
GENERAL ELECTRIC	GSC902	787	65
GENERAL ELECTRIC	GSC452	800	66
GENERAL ELECTRIC	GSC702	800	66
GENERAL ELECTRIC	GSD500D	826	68
GENERAL ELECTRIC	GSM603D	852	71
GENERAL ELECTRIC	GSD2*00D	852	71
GENERAL ELECTRIC	GSD1200T	852	71
GENERAL ELECTRIC	GSD6*0D	852	71
GENERAL ELECTRIC	GSD9*0D	852	71
GENERAL ELECTRIC	GSD1000T	890	74
GENERAL ELECTRIC	GSD980T	890	74
GENERAL ELECTRIC	GSD900T	890	74
GENERAL ELECTRIC	GSC402	903	75
GENERAL ELECTRIC	GSD2500	917	76
GENERAL ELECTRIC	GSD400Y	1071	89
GLENWOOD RANGE	GAX95DW	955	79
GRAY AND DUDLEY	SWP*	955	79
GRAY AND DUDLEY	DWP*-1	955	79
HOTPOINT	HDA965	787	65
HOTPOINT	HDB921	787	65
HOTPOINT	HDA865	800	66
HOTPOINT	HDB821	800	66
HOTPOINT	HDA7*5	800	66
HOTPOINT	HDA465	903	75
HOTPOINT	HDB721	903	75
JENN-AIR	D*471	929	77
JENN-AIR	DU401	929	77
JENN-AIR	DU491	929	77
JENN-AIR	D*451	929	77
KITCHENAID	SUBERBA	826	68
KITCHENAID	NONWATERHEATING	877	73
KITCHENAID	IMPERIAL	968	80
MAGIC CHEF	DU18D4	697	58
MAGIC CHEF	DU24D*	955	79
MAGIC CHEF	DU*5A	975	81
MAGIC CHEF	DU*0A	975	81
MAGIC CHEF	DU5*A	994	82
MAYTAG	WU1000	929	77
MAYTAG	WC*02	929	77
MAYTAG	WU482	929	77
MAYTAG	WU*02	929	77
MODERN MAID	ZDW855L	955	79
MODERN MAID	XDW880L	955	79
MODERN MAID	ADW860L	955	79
PANASONIC	NP-416F	955	79
PANASONIC	NP-404U	955	79
PANASONIC	NP-408U	955	79
PANASONIC	NP-406U	955	79

MANUFACTURER/NAME	MODEL NUMBER	KWH/YR	KWH/M
PEERLESS	DW180-C	697	58
PEERLESS	DW220*	955	79
PEERLESS	DW630*	955	79
ROPER	8515-L00	697	58
ROPER	8505-L*0	955	79
ROPER	8585-L*0	955	79
ROPER	8595-L*0	955	79
ROPER	8575-L00	955	79
ROPER	8565-L00	955	79
ROPER	8575-L10	1006	83
SEARS	587.151800	645	53
SEARS	587.733*02	697	58
SEARS	587.736*12	697	58
SEARS	587.703*03	877	73
SEARS	587.736*12	877	73
SEARS	587.153200	877	73
SEARS	587.153100	877	73
SEARS	587.15*303	877	73
SEARS	1591580	955	79
SEARS	15*6580	955	79
SEARS	587.155*02	1006	83
SEARS	587.153000	1006	83
TAPPAN	61-11*4	975	81
THERMADOR	WSK3400	917	76
THERMADOR	WSK2300	917	76
THERMADOR	THD2600	917	76
THERMADOR	THD3600	917	76
THERMADOR	WSK1200	975	81
THERMADOR	THD4600	1006	83
WHIRLPOOL	GDU4050XPW	606	50
WHIRLPOOL	DU9900XR	774	64
WHIRLPOOL	DU550*X*	774	64
WHIRLPOOL	DU9000XR	774	64
WHIRLPOOL	DU750*X*	774	64
WHIRLPOOL	D*6000XR	774	64
WHIRLPOOL	DU8000XR	774	64
WHIRLPOOL	DU9500XR	890	74
WHIRLPOOL	DU9700XR	890	74
WHIRLPOOL	DU4500XR	941	78
WHIRLPOOL	DU3000XR	941	78
WHIRLPOOL	DU3016XR	941	78
WHIRLPOOL	DU4000XR	941	78
WHIRLPOOL	DU1098XR	941	78
WHIRLPOOL	DP3000XR	941	78

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
ADMIRAL	AD480*#	68.8	119
ADMIRAL	AD460*#	68.8	93
ADMIRAL	WL550	68.8	69
ADMIRAL	AD450*#	68.8	77
ADMIRAL	WA45^0830	68.8	77
ADMIRAL	WA48^0820	68.8	119
ADMIRAL	WA47^0830	68.8	77
ADMIRAL	AB4300	68.8	86
ADMIRAL	AD430*#	66.8	76
ADMIRAL	AD440*#	68.8	76
ADMIRAL	WA46^0820	68.8	77
ADMIRAL	WA44^0820	68.8	77
ADMIRAL	WA56^0820	68.8	69
BEAUMARK	5102#	64.0	54
BEAUMARK	540##	77.0	128
BEAUMARK	5703#	77.0	124
BEAUMARK	560##	77.0	124
BEAUMARK	550##	77.0	125
BEAUMARK	555##	77.0	115
BRENTWOOD	WWG1152	77.0	125
BRENTWOOD	WWG1132	77.0	128
ECON-O-WASH	KA3001	69.7	70
ECON-O-WASH	KA4011	69.7	84
ECON-O-WASH	KA4010	69.7	84
ECON-O-WASH	KA5001	69.7	70
ECON-O-WASH	KA4211	69.7	84
ECON-O-WASH	KA6001	69.7	84
ECON-O-WASH	KA3000	69.7	70
GENERAL ELECTRIC	W644V	77.0	124
GENERAL ELECTRIC	W681V	77.0	128
GENERAL ELECTRIC	W530E	77.0	125
GENERAL ELECTRIC	W675E	77.0	124
GENERAL ELECTRIC	W540V	77.0	124
GENERAL ELECTRIC	W540E	77.0	124
GENERAL ELECTRIC	W530V	77.0	125
GENERAL ELECTRIC	W575V	77.0	124
GENERAL ELECTRIC	W830V	77.0	125
GENERAL ELECTRIC	W870V	77.0	124
GENERAL ELECTRIC	W673E	77.0	125
GENERAL ELECTRIC	W682E	77.0	124
GENERAL ELECTRIC	W850V	77.0	124
GENERAL ELECTRIC	W870E	77.0	124
GENERAL ELECTRIC	W573V	77.0	125
GENERAL ELECTRIC	W850E	77.0	124
GENERAL ELECTRIC	W681E	77.0	125
GENERAL ELECTRIC	W830E	77.0	125
GENERAL ELECTRIC	VW533V	77.0	125
GENERAL ELECTRIC	W682V	77.0	124
HITACHI	PAF-760P	60.0	54
HITACHI	PF-150LP	60.0	61
HITACHI	PF950F	60.0	61
HOTPOINT	LA420D	77.0	128
HOTPOINT	LH543D	77.0	124
HOTPOINT	LA414D	77.0	128

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
HOTPOINT	LA442D	77.0	125
HOTPOINT	LA445D	77.0	115
HOTPOINT	LH457D	77.0	110
HOTPOINT	LH452D	77.0	124
HOTPOINT	LA448D	77.0	125
INGLIS	R0460^0	68.8	119
INGLIS	R0403^0	68.8	160
INGLIS	R0535^0	68.8	110
INGLIS	R0541^0	68.8	110
INGLIS	U0430*#	68.8	76
INGLIS	R0530^0	68.8	110
INGLIS	R0531^0	68.8	110
INGLIS	T0481	68.8	116
INGLIS	T0540	68.8	110
INGLIS	R0481^3	68.8	116
INGLIS	T0531	68.8	110
INGLIS	T0441	68.8	119
INGLIS	T0435	68.8	93
INGLIS	T0445	68.8	119
INGLIS	T0430	68.8	86
INGLIS	R0430^0	68.8	119
INGLIS	U0540*#	68.8	84
INGLIS	R0440^0	68.8	119
INGLIS	U0535*#	68.8	84
INGLIS	T0530	68.8	74
INGLIS	U0530*#	68.8	67
INGLIS	R0441^0	68.8	119
INGLIS	U0481*#	68.8	116
INGLIS	R0540^0	68.8	110
INGLIS	U0470*#	68.8	116
INGLIS	T0460	68.8	116
INGLIS	U0460*#	68.8	116
INGLIS	T0431	68.8	119
INGLIS	U0445*#	68.8	119
INGLIS	T0470	68.8	119
INGLIS	U0441*#	68.8	119
INGLIS	R0445^0	68.8	119
INGLIS	U0440*#	68.8	93
INGLIS	T0440	68.8	119
INGLIS	U0435*#	68.8	93
INGLIS	R0470^0	68.8	116
INGLIS	T0535	68.8	84
INGLIS	R0431^0	68.8	119
INGLIS	U0432*#	68.8	119
INGLIS	R0560^0	68.8	110
INGLIS	R0435^0	68.8	119
INGLIS	T0442	68.8	119
INGLIS	U0431*#	68.8	91
KENMORE	5051 SERIES	68.8	113
KENMORE	5230 SERIES	68.8	73
KENMORE	5450 SERIES	68.8	113
KENMORE	4420 SERIES	68.8	72
KENMORE	4290 SERIES	68.8	123
KENMORE	5420 SERIES	68.8	65

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
KENMORE	4450 SERIES	68.8	123
KENMORE	4415 SERIES	68.8	126
KENMORE	5261 SERIES	68.8	88
KENMORE	4516 SERIES	68.8	110
KENMORE	4250 SERIES	68.8	97
KENMORE	5250 SERIES	68.8	88
KENMORE	4251 SERIES	68.8	97
KENMORE	4231 SERIES	68.8	82
KENMORE	4260 SERIES	68.8	97
KENMORE	5231 SERIES	68.8	73
KENMORE	4261 SERIES	68.8	97
KENMORE	4430 SERIES	68.8	123
KENMORE	4224 SERIES	68.8	110
KENMORE	4514 SERIES	68.8	110
KENMORE	4416 SERIES	68.8	110
KENMORE	4051 SERIES	68.8	123
KENMORE	5260 SERIES	68.8	88
KENMORE	4091 SERIES	68.8	123
KENMORE	5460 SERIES	68.8	113
KENMORE	5251 SERIES	68.8	88
KENMORE	4460 SERIES	68.8	123
KENMORE	4230 SERIES	68.8	82
KENMORE	5430 SERIES	68.8	113
MAYTAG	A210	70.8	88
MAYTAG	A310S	70.8	75
MAYTAG	A305	70.8	72
MAYTAG	A104	70.8	78
MAYTAG	A112	70.8	72
MAYTAG	A312S	70.8	65
MAYTAG	A212S	70.8	65
MAYTAG	A209S	70.8	65
MAYTAG	A210S	70.8	79
MAYTAG	A209	70.8	72
MAYTAG	A180	70.8	78
MAYTAG	A312	70.8	72
MAYTAG	A211S	70.8	65
MAYTAG	A212	70.8	72
MAYTAG	A181	70.8	78
MAYTAG	A310	70.8	82
MAYTAG	A110	70.8	78
MAYTAG	A211	70.8	72
MCCLARY	YWG1172	77.0	125
MCCLARY	YWG1172	77.0	125
MOFFAT	MWG1140	77.0	104
MOFFAT	MWG1120	77.0	128
MOFFAT	MWG1150	77.0	125
VIKING	EW880B	77.0	99
VIKING	EW500E	77.0	124
VIKING	EW900E	77.0	124
VIKING	EW140S	77.0	142
VIKING	EW700E	77.0	124
VIKING	EW520S	77.0	125
VIKING	EW560S	77.0	124
VIKING	EW300E	77.0	144

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
VIKING	EW540S	77.0	125
VIKING	EW160S	77.0	128
VIKING	EW545S	77.0	115
WHIRLPOOL	WL450	68.8	77
WHIRLPOOL	JLHA5471^0	68.8	106
WHIRLPOOL	JLHA4201^0	68.8	160
WHIRLPOOL	JLHA5401^0	68.8	106
WHIRLPOOL	JLHA5501^0	68.8	106
WHIRLPOOL	WL440	68.8	77
WHIRLPOOL	WL420	68.8	77
WHIRLPOOL	WL550^0	68.8	69
WHIRLPOOL	WL430	68.8	77
WHIRLPOOL	JLHA4501^0	68.8	120
WHIRLPOOL	JLHA5301^0	68.8	106
WHIRLPOOL	JLHA4431^0	68.8	120
WHIRLPOOL	WN431*#	68.8	77
WHIRLPOOL	JLHA4351^0	68.8	120
WHIRLPOOL	WN441*#	68.8	95
WHIRLPOOL	WL443	68.8	120
WHIRLPOOL	WN446*#	68.8	95
WHIRLPOOL	WL470	68.8	116
WHIRLPOOL	WN456*#	68.8	120
WHIRLPOOL	JLHA4202^0	68.8	77
WHIRLPOOL	WN466*#	68.8	120
WHIRLPOOL	JLHA4401^0	68.8	120
WHIRLPOOL	WN476*#	68.8	116
WHIRLPOOL	JLHA4701^0	68.8	116
WHIRLPOOL	WN556*#	68.8	110
WHIRLPOOL	JLHA4471^0	68.8	120
WHIRLPOOL	WL530^0	68.8	69
WHIRLPOOL	JLHA4301^0	68.8	120
WHIRLPOOL	WL435	68.8	95
WHITE-WESTINGHOUSE	WLT-250	63.7	54
WHITE-WESTINGHOUSE	WLT-250E	63.7	50
WHITE-WESTINGHOUSE	WLT-170-2	64.0	54
WHITE-WESTINGHOUSE	WLT-170-3	64.0	54
WHITE-WESTINGHOUSE	WLT-170	64.0	61
WHITE-WESTINGHOUSE	WLP440J	70.0	89

RANGES 30" 60-75L - CANADA

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
BEAUMARK	13440	72.1	70
BEAUMARK	13460	72.1	71
BEAUMARK	13450	72.1	71
BEAUMARK	13480	72.1	71
BRENTWOOD	WSM3062X	68.6	64
BRENTWOOD	WSM3055	68.6	64
BRENTWOOD	WSM3035	68.6	63
BRENTWOOD	WSM3075	68.6	64
BRENTWOOD	WSM3042X	68.6	63
BRENTWOOD	WSM3052X	68.6	63
FRIGIDAIRE	FE302N	72.1	71
FRIGIDAIRE	RE430N	72.1	71
FRIGIDAIRE	RG430N	72.1	71
FRIGIDAIRE	FE304N	72.1	71
FRIGIDAIRE	RB430N	72.1	71
FRIGIDAIRE	RP420N	72.1	71
FRIGIDAIRE	RE440N	72.1	71
FRIGIDAIRE	FE301N	72.1	71
GENERAL ELECTRIC	J34CD	68.6	64
GENERAL ELECTRIC	J34EE	68.6	63
GENERAL ELECTRIC	J34FE	68.6	63
GENERAL ELECTRIC	J34MC	68.6	64
GENERAL ELECTRIC	VJ32BE	68.6	63
GENERAL ELECTRIC	J34TC	68.6	64
GENERAL ELECTRIC	J34EC	68.6	63
GENERAL ELECTRIC	J34MD	68.6	64
GENERAL ELECTRIC	J34FC	68.6	63
GENERAL ELECTRIC	J34SC	68.6	67
GENERAL ELECTRIC	J34CC	68.6	64
GENERAL ELECTRIC	J34LC	68.6	64
GENERAL ELECTRIC	VJ32ZB	68.6	63
GENERAL ELECTRIC	J34SE	68.6	67
GENERAL ELECTRIC	JC4LE	68.6	64
GENERAL ELECTRIC	J34ME	68.6	64
GENERAL ELECTRIC	J34CE	68.6	64
GENERAL ELECTRIC	J34AV	74.2	65
GENERAL ELECTRIC	J34EB	74.2	64
GENERAL ELECTRIC	J34CV	74.2	65
GENERAL ELECTRIC	J34DB	74.2	64
GENERAL ELECTRIC	J34LB	74.2	65
GENERAL ELECTRIC	J34NV	74.2	64
GENERAL ELECTRIC	J34FB	74.2	64
GENERAL ELECTRIC	J34MV	74.2	65
GENERAL ELECTRIC	VJ34MV	74.2	65
GENERAL ELECTRIC	J34TV	74.2	64
HOTPOINT	KE430G	68.6	63
HOTPOINT	KE234G	68.6	63
HOTPOINT	KE232G	68.6	63
HOTPOINT	KE238G	68.6	63
HOTPOINT	KE230H	68.6	64
HOTPOINT	KE438G	68.6	63
HOTPOINT	KE730G	68.6	64
HOTPOINT	KE430H	68.6	63
HOTPOINT	KE230G	68.6	64

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
HOTPOINT	KE636G	68.6	64
HOTPOINT	KE234H	68.6	63
HOTPOINT	KE630G	68.6	64
HOTPOINT	KE438H	68.6	63
HOTPOINT	KE630H	68.6	64
HOTPOINT	KE739H	68.6	67
HOTPOINT	KE232H	68.6	63
HOTPOINT	KE238H	68.6	63
HOTPOINT	KE532H	68.6	64
HOTPOINT	KE220C	74.2	66
HOTPOINT	KE232F	74.2	64
HOTPOINT	KE333E	74.2	65
HOTPOINT	KE536D	74.2	65
HOTPOINT	KE530C	74.2	65
HOTPOINT	KE632E	74.2	64
HOTPOINT	K3730C	74.2	65
HOTPOINT	KE533D	74.2	65
HOTPOINT	KE438D	74.2	64
HOTPOINT	KE233E	74.2	64
IMPERIAL	3125JCD	72.1	71
KELVINATOR	DC3N	72.1	71
KELVINATOR	KE301N	72.1	71
KELVINATOR	M3N	72.1	70
KELVINATOR	XD3N	72.1	71
KELVINATOR	KE302N	72.1	71
KELVINATOR	D3N	72.1	71
KELVINATOR	KE304N	72.1	71
KELVINATOR	XM3N	72.1	71
KELVINATOR	PM3N	72.1	70
KENMORE	65050 SERIES	68.6	63
KENMORE	67471 SERIES	68.6	67
KENMORE	67441 SERIES	68.6	67
KENMORE	66151 SERIES	68.6	64
KENMORE	67051 SERIES	68.6	64
KENMORE	67150 SERIES	68.6	63
KENMORE	67140 SERIES	68.6	66
KENMORE	68350 SERIES	68.6	63
KENMORE	67440 SERIES	68.6	66
KENMORE	6832 SERIES	68.6	64
KENMORE	67450 SERIES	68.6	66
KENMORE	6704 SERIES	68.6	64
KENMORE	67141 SERIES	68.6	67
KENMORE	65051 SERIES	68.6	64
KENMORE	67451 SERIES	68.6	67
KENMORE	66150 SERIES	68.6	63
KENMORE	67151 SERIES	68.6	64
KENMORE	6604 SERIES	68.6	64
KENMORE	6834 SERIES	68.6	64
MCCLARY	YSM5052X	68.6	64
MCCLARY	YSM3072X	68.6	64
MCCLARY	YSM3035	68.6	63
MCCLARY	YSM3032X	68.6	63
MOFFAT	VSM315	68.6	63
MOFFAT	MSM7252X	68.6	63

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
MOFFAT	MSM3075	68.6	64
MOFFAT	VSM3133	68.6	63
MOFFAT	MSM6065	68.6	63
MOFFAT	VSM3122	68.6	63
MOFFAT	MSM7372X	68.6	64
MOFFAT	MSM3065	68.6	66
MOFFAT	MSM6052X	68.6	64
MOFFAT	VSM3125	68.6	63
MOFFAT	YSM3055	68.6	64
MOFFAT	YSM3075	68.6	64
MOFFAT	MSM7275	68.6	64
MOFFAT	MSM2042X	68.6	63
MOFFAT	MSM3062X	68.6	63
MOFFAT	MSM6055	68.6	64
MOFFAT	MSM3072X	68.6	64
MOFFAT	MSM6022X	68.6	64
MOFFAT	VSM3163	68.6	64
MOFFAT	MSM3055	68.6	64
VIKING	SE3025	72.1	70
VIKING	SE3035	72.1	71
WHITE-WESTINGHOUSE	WF440N	72.1	70
WHITE-WESTINGHOUSE	WFP570N	72.1	71
WHITE-WESTINGHOUSE	WFP630N	72.1	70
WHITE-WESTINGHOUSE	WFP670N	72.1	71
WHITE-WESTINGHOUSE	WF340N	72.1	70
WHITE-WESTINGHOUSE	WFC650N	72.1	71
WHITE-WESTINGHOUSE	WFB640N	72.1	71

CLOTHES DRYERS - CANADA

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
ADMIRAL	DE84^082	167	89
ADMIRAL	DE85^083	167	89
ADMIRAL	AB830^0	167	89
BEAUMARK	6201#	168	94
BEAUMARK	62050	168	94
BEAUMARK	6303#	168	94
BRENTWOOD	WDG1132	168	94
ECON-O-WASH	KE2003	163	97
FRIGIDAIRE	FDD183J	143	89
FRIGIDAIRE	1123E	143	89
FRIGIDAIRE	1123D	143	89
FRIGIDAIRE	FDD183M	143	89
FRIGIDAIRE	FDD183K	143	89
FRIGIDAIRE	FDD182H	143	89
GENERAL ELECTRIC	D512E	168	94
GENERAL ELECTRIC	D681E	168	111
GENERAL ELECTRIC	D830E	168	111
GIBSON	DTS11M	143	89
GIBSON	DTS11K	143	89
GIBSON	DTP11J	143	89
GIBSON	1123B	143	89
GIBSON	DTS11J	143	89
GIBSON	1123C	143	89
GIBSON	1123E	143	89
HOTPOINT	DE314	168	94
HOTPOINT	DE740E	168	94
HOTPOINT	DE302	168	94
HOTPOINT	DE744E	168	94
HOTPOINT	DE622E	168	94
HOTPOINT	DE320	168	94
IMPERIAL	1123B	143	89
IMPERIAL	1123C	143	89
INGLIS	T0800^0	167	89
INGLIS	T0830^0	167	89
INGLIS	R0800^0	167	89
INGLIS	R0830^0	167	89
KELVINATOR	1123D	143	89
KELVINATOR	AD3K	143	89
KELVINATOR	DP1J	143	89
KELVINATOR	1123B	143	89
KELVINATOR	AD3M	143	89
KELVINATOR	1123E	143	89
KELVINATOR	1123C	143	89
KENMORE	8011 SERIES	167	89
KENMORE	8210 SERIES	167	89
KENMORE	8001 SERIES	167	89
KENMORE	8211 SERIES	167	89
KENMORE	8200 SERIES	167	89
KENMORE	8410 SERIES	167	89
KENMORE	8201 SERIES	167	89
LEONARD	AD3K	143	89
LEONARD	1123C	143	89
LEONARD	AD3M	143	89
LEONARD	DP1J	143	89

MANUFACTURER/NAME	MODEL NUMBER	SIZE	KWH/M
LEONARD	1123E	143	89
LEONARD	1123B	143	89
MAYTAG	DE110	169	91
MAYTAG	DE212	169	91
MAYTAG	DE210	169	91
MCCLARY	YDG1120E	168	94
MOFFAT	MDG1120E	168	94
ROY	DTS11K	143	89
ROY	1123C	143	89
ROY	DTP11J	143	89
ROY	DTS11M	143	89
ROY	DTS11J	143	89
ROY	1123E	143	89
ROY	1123B	143	89
VIKING	ED100E	168	94
VIKING	ED300E	168	94
VIKING	ED140	168	94
VIKING	ED120	168	94
WHIRLPOOL	WL820^0	167	89
WHIRLPOOL	WL830^0	167	89
WHIRLPOOL	JLHE8201^0	167	89
WHIRLPOOL	JLHE8301^0	167	89
WHITE-WESTINGHOUSE	WDP440J	143	89
WHITE-WESTINGHOUSE	WDE420J	143	89
WHITE-WESTINGHOUSE	1123C	143	89
WHITE-WESTINGHOUSE	1123B	143	89

APPENDIX F

BACKGROUND ON U.S. NATIONAL APPLIANCE ENERGY CONSERVATION ACT OF 1987

APPENDIX F-1

CONSUMER REPORTS OCTOBER 1985

APPLIANCES

Court directs Government to set appliance standards

The 10-year-long effort to make home appliances more energy efficient—which the Reagan Administration has consistently opposed—received a boost in July from a Federal court decision.

Back in 1975, Congress ordered the Department of Energy to set mandatory standards for energy use by major household appliances. But in 1982 and 1983, the DOE said it would set no appliance standards at all, because they wouldn't be economically justified or result in a "significant" saving of energy.

Responding to a lawsuit brought by the Natural Resources Defense Council and Consumers Union, the U.S. Court of Appeals for the District of Columbia has now ordered the DOE to formulate a set of standards after all.

In its decision, the court criticized many of the premises the DOE had used to justify its inaction. For instance, the court noted that the agency had set such a strict definition for "significant" energy saving that many appliances couldn't meet it even if their energy consumption were reduced to zero.

The court told the agency "to carry out faithfully its legislative charter." It didn't order any particular outcome, just a more fair consideration of the issues. A DOE representative said the Government hasn't yet decided whether to appeal the decision to the U.S. Supreme Court.

In the absence of Federal standards, appliance manufacturers have had to contend with a hodgepodge of state energy regulations. According to the Association of Home Appliance Manufacturers, at least 26 states have adopted some sort of appliance efficiency standards. One of the strictest is California, which has set energy-efficiency requirements for refrigerators, freezers, and air-conditioners. "It's about as chaotic a situation as you can imagine," said an AHAM spokesperson.

APPENDIX F-2

Coalition for Federal Appliance Efficiency Standards

January 20, 1987

COALITION MEMBERSHIP

AIR-CONDITIONING AND REFRIGERATION INSTITUTE
AIR CONDITIONING AND REFRIGERATION WHOLESALERS
AIR CONDITIONING CONTRACTORS OF AMERICA
ALLIANCE TO SAVE ENERGY
AMERICAN ASSOCIATION OF RETIRED PERSONS
AMERICAN CONSULTING ENGINEERS COUNCIL
AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY
AMERICAN PUBLIC POWER ASSOCIATION
AMERICAN RETAIL FEDERATION
AMERICAN SUPPLY ASSOCIATION
ASSOCIATION OF HOME APPLIANCE MANUFACTURERS
CITIZENS/LABOR ENERGY COALITION
CONSUMER ENERGY COUNCIL OF AMERICA
CONSUMER FEDERATION OF AMERICA
CONSUMERS UNION
EDISON ELECTRIC INSTITUTE
ELECTRONIC INDUSTRIES ASSOCIATION/CONSUMER ELECTRONIC GROUP
ENERGY CONSERVATION COALITION
ENVIRONMENTAL ACTION
ENVIRONMENTAL POLICY INSTITUTE
FEDERATION OF AMERICAN SCIENTISTS
FRIENDS OF THE EARTH
FUND FOR RENEWABLE ENERGY AND THE ENVIRONMENT
GAS APPLIANCE MANUFACTURERS ASSOCIATION
THE HYDRONICS INSTITUTE
INTERNATIONAL INSTITUTE FOR ENERGY CONSERVATION
MANUFACTURED HOUSING INSTITUTE
MECHANICAL CONTRACTORS ASSOCIATION OF AMERICA
NATIONAL ASSOCIATION OF HOME BUILDERS
NATIONAL ASSOCIATION OF MANUFACTURERS
NATIONAL ASSOCIATION OF PLUMBING - HEATING - COOLING CONTRACTORS
NATIONAL ASSOCIATION OF REGULATORY UTILITY COMMISSIONERS
NATIONAL ASSOCIATION OF RETAIL DEALERS OF AMERICA
NATIONAL RETAIL MERCHANTS ASSOCIATION
NATIONAL RURAL ELECTRIC COOPERATIVE ASSOCIATION
NATIONAL AUDUBON SOCIETY
NATIONAL CONSUMERS LEAGUE
NATIONAL WILDLIFE FEDERATION
NATURAL RESOURCES DEFENSE COUNCIL
NORTHAMERICAN HEATING AND AIRCONDITIONING WHOLESALERS ASSOCIATION
NORTHWEST CONSERVATION ACT COALITION
SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION
SIERRA CLUB
SOLAR ENERGY ASSOCIATION OF OREGON
UNION OF CONCERNED SCIENTISTS
UNITED METHODIST CHURCH BOARD OF CHURCH AND SOCIETY
U.S. PUBLIC INTEREST RESEARCH GROUP

1501 Wilson Boulevard • Suite 600 • Arlington, Virginia 22209 • Hotline (703) 528-8854

APPENDIX F-3

Calendar No. 15

100th Congress *1st Session*	SENATE	Report 100-6

NATIONAL APPLIANCE ENERGY CONSERVATION ACT OF 1987

January 30, 1987.—Ordered to be printed

Filed under authority of the order of the Senate of January 29, 1987

Mr. Johnston, from the Committee on Energy and Natural Resources, submitted the following

REPORT

[To accompany S. 83]

The Committee on Energy and Natural Resources, to which was referred the bill (S. 83) to amend the Energy Policy and Conservation Act with respect to energy conservation standards for appliances, having considered the same, reports favorably thereon with amendments to the text and recommends that the bill (as amended) do pass.

The amendments are as follows:

1. On page 3, line 7, delete the word "and" and insert in lieu thereof the word "or".

2. On page 3, line 8, before the semicolon insert "and does not communicate with air in the conditioned space".

3. On page 20, between lines 16 and 17 insert the words "in gallons" following the word "Volume" each place it appears.

4. On page 23, line 13, delete the word "and".

5. On page 23, line 17, delete "percent." and insert in lieu thereof "percent; and".

6. On page 23, between lines 17 and 18 insert the following: " '(iii) which the Secretary determines is not likely to result in a significant shift from gas heating to electric resistance heating with respect to either residential construction or furnace replacement.' ".

7. On page 49, line 5 delete the word "basis." and insert in lieu thereof "or equivalent cost basis.".

91-010 O

PURPOSE

The purpose of S. 83 is to reduce the Nation's consumption of energy and to reduce the regulatory and economic burdens on the appliance manufacturing industry through the establishment of national energy conservation standards for major residential appliances.

SUMMARY OF MAJOR PROVISIONS

There are two basic provisions to the measure: The establishment of Federal standards and the preemption of State standards.

Standards: Federal standards are established to take effect in 1988, 1990, 1992, or 1993, depending on the product, and are to remain in effect from 3 to 10 years, also depending on the product. After the 3 to 10 year "lock-in" period, DOE may promulgate new standards for each product which may not be less than those established by the legislation. The 12 covered products are: refrigerators and freezers; room air conditioners; central air conditioners and heat pumps; water heaters; furnaces; washers; clothes washers; clothes dryers; direct heating equipment; kitchen ranges and ovens; pool heaters; and television sets. The standards in most cases are as strong as, or stronger than, any State standards currently in effect.

Preemption: In general, these national standards would preempt all State standards. However, States may petition DOE for a waiver from the Federal standards. Moreover, State standards enacted before January 8, 1987, and which become effective before January 3, 1988, are "grandfathered" by the bill and will remain effective until the appropriate Federal standard begins.

States may petition DOE to be waived from Federal preemption, but achieving the waiver is difficult. In order to receive a waiver a State must show that its regulation is needed to meet "unusual and compelling State and local interests." These interests are defined as being substantially different in nature or magnitude from those of the Nation generally. Furthermore, DOE may not grant a waiver if interested persons show that the State regulation will significantly burden marketing, manufacturing, distribution, sale or servicing of appliance products nationally. Nor may DOE grant a waiver if interested persons show that the State regulation is likely to result in the unavailability in the State of a product type or of products of a particular performance class, such as frost-free refrigerators. A waiver would become effective 3 years after it is granted by DOE, or after 5 years if the Secretary finds that the time is needed for redesign or retooling, etc.

In general, a State may not receive a waiver either prior to effective date of the Federal Standard or during the 3 to 10 year "lock-in" period for the Federal standards except if the State can show that an "energy emergency condition" exists within the State which imperils the health, safety and welfare of its residents.

The law would also restrict related State enacted performance-based building codes. They may be adopted by States only if they do not require the installation of covered products which have efficiencies exceeding the applicable Federal standard.

Because the State of California has already enacted standards and has been very active on this issue, special provisions are included in the bill relating to these State standards. In the case of the refrigerator/freezer standard, if DOE does not promulgate a final rule establishing a new Federal standard following the initial "lock-in" period ending January 1, 1993, then California's second tier standards (now to be effective on January 1, 1992) would go into effect on January 1, 1993, but only in California, without California receiving a waiver from Federal exemption.

Test procedures, enforcement, and reporting: S. 83 has three other general provisions relating to test procedures, enforcement, and reporting. First, test procedures would not change from existing law unless DOE recommends their revision. In this case, S. 83 requires that standards shall be adjusted so that revisions of the test procedures do not affect the actual stringency of the standards. Second, the bill would provide expeditious judicial relief should DOE fail to comply with statutory deadlines by stating that there is a Federal cause of action in such cases and that the courts are required to advance and expedite such cases. Section 336 of EPCA relating to administrative procedures and judicial review remains essentially intact except for technical changes and the addition of a new subsection to allow persons to seek declaratory judgments that State building codes do not comply with the Act. S. 83 does not require a State to petition DOE to show that their building codes are consistent with the Act. Finally, as for reporting, DOE may require submission of reports by manufacturers but DOE would be required to use existing information when possible and to minimize industry's reporting burden.

BACKGROUND AND NEED

In 1975, Congress passed the Energy Policy and Conservation Act (EPCA) (Public Law 94-163) which required the Department of Energy (DOE) to mandate energy efficiency labeling of major residential appliances and to prescibe voluntary industry appliance efficiency improvements. In addition, EPCA authorized, but did not require, DOE to establish mandatory efficiency standards if necessary. In 1978, Congress enacted the National Energy Conservation Policy Act (NECPA) (Public Law 95-619) which amended EPCA to require that energy efficiency standards be established for each of 13 classes of appliances that are major consumers of energy. The standards, which would preempt State laws on appliance efficiency, were to "be designed to achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified."

The Department proceeded with rulemaking and in 1980 issued proposed standards for 8 of the 13 classes of covered appliances. In January of 1981, however, the Department suspended this process and announced in April 1982 a finding that no standards were economically justified. The DOE adoption of this "no-standard" standard precluded individual States from adopting their own efficiency standards due to the preemption provisions of EPCA.

The "no-standard" standard was immediately challenged in court by the Natural Resources Defense Council (NRDC) which sued to overturn the standards as thwarting the congressional intent that Federal standards be established. On July 16, 1985, the D.C. Circuit Court of Appeals issued a unanimous decision striking down the "no-standard" standards as ". . . contrary to law" and directing DOE to initiate a new rulemaking in accordance with the statutory intent of NECPA (*NRDC* v. *Herrington*, 768 F.2d 1355 (D.C. Cir. 1985)). That new rulemaking is still in progress.

It is currently estimated that approximately 18 percent of the Nation's energy is consumed by major home appliances such as furnaces, hot water heaters, clothes washers and dryers, air conditoners, refrigerators, stoves, etc. Since the energy price increases of the early 1970's, appliance efficiency has been the subject of national interest.

During the 1970's some States began enacting appliance efficiency standards on their own. NECPA provides that the Federal standards preempt State standards, except that States may petition DOE to grant a waiver from preemption if a State is able to show justification for its standards over those of DOE. While DOE adopted its policy of the "no-standard" standards, it also initiated a general policy of granting petitions from States requesting waivers from preemption. As a result, a system of separate State appliance standards has begun to emerge and the trend is growing.

Because of this trend, appliance manufacturers were confronted with the problem of a growing patchwork of differing State regulations which would increasingly complicate their design, production and marketing plans. Regulations in a few populous States could as a practical matter determine the product lines sold nationwide, even in States where no regulations existed. In an effort to resolve this problem the major appliance manufacturer associations began negotiations with the Natural Resources Defense Council in early 1986. At the end of July an agreement was reached and it was embodied in legislation which was introduced on August 15, 1986, in the House (H.R. 5465) and in the Senate (S. 2781). H.R. 5465 was passed without objection by both Houses of Congress on October 15, 1986 and with only four substantive changes:

1. Television sets were added as a covered product for which the Secretary of Energy may prescribe an energy conservation standard (section 322(a)(12) and section 325(i)(3)).
2. An energy conservation standard was established for the heating cycle of heat pumps (section 325(d)(2) and section 325(d)(3)(A)).
3. The energy conservation standards for furnaces were modified to provide different treatment for furnaces having an input of less than 45,000 Btu's per hour (section 325(f)(B)).
4. Two new sections were added which did not relate to appliance standards, but instead dealt with issues pending before the Federal Energy Regulatory Commission.

On November 1, 1986, H.R. 5465 was pocket-vetoed by the President. The President's Memorandum of Disapproval stated that: "The bill intrudes unduly on the free market, limits the freedom of choice available to consumers who would be denied the opportunity to purchase lower-cost applicances, and constitutes a substantial intrusion into traditional state responsibilities and prerogatives."

As introduced, S. 83 is the same legislation which was unanimously approved by Congress last October, except that sections 12 and 13 of last year's bill, regarding issues unrelated to appliance efficiency, have been deleted.

LEGISLATIVE HISTORY

Last year, S. 2781 and the House companion measure, H.R. 5465, were introduced on August 15, 1986. The Subcommittee on Energy Regulation and Conservation held a hearing (S. Hrg. 99-943) on S. 2781 on September 16, 1986. On September 22, 1986, the House passed H.R. 5465 and it was reported (S. Rpt. 99-497) by the Senate Committee on Energy and Natural Resources on September 24, 1986 in lieu of S. 2781. The Senate passed H.R. 5465, and the House concurred with the Senate amendments, on October 15, 1986. The measure was pocket-vetoed on November 1, 1986. S. 83 was introduced on January 6, 1987, as was House companion measure H.R. 87.

COMMITTEE RECOMMENDATIONS AND TABULATION OF VOTES

The Committee on Energy and Natural Resources, in open business session on January 28, 1987, without objection of a quorum present, recommended that the Senate pass S. 83, if amended as described herein.

COMMITTEE AMENDMENTS

The Committee ordered S. 83 reported with seven amendments.

1. On page 3, line 7, delete the word "and" and insert in lieu thereof the word "or". This is a technical amendment.

2. On page 3, line 8, before the semicolon insert "and does not communicate with air in the conditioned space". This is a clarifying amendment with the result that, for the purposes of testing, it is assumed that all combustion and ventilation air used by warm air furnaces is admitted through grills or ducts from outdoors and does not communicate with air in the conditioned (heated) space. In effect, then the furnace is assumed to be isolated from the conditioned space, i.e., the living space. This was the intent of the bill as passed last year.

3. On page 20, between lines 16 and 17, insert the words "in gallons" following the word "Volume" each place it appears. This is a clarifying amendment to identify the unit of measurement to be used for the storage volume of water heaters when calculating energy factors.

4, 5, and 6. On page 23, lines 13 through 18, the Committee modified the language of the bill amending section 325(f)(1)(B) of EPCA to include an additional clause (iii). The purpose of the new clause is to clarify that, in setting an energy conservation standard for small gas furnaces (those having an input of less than 45,000 Btu's per hour), the Secretary of Energy shall, in a manner which is otherwise consistent with this Act, establish the standard at a level between 71 percent and 78 percent AFUE "which the Secretary determines is not likely to result in a significant shift from gas heating to electric resistance heating with respect to either residential construction or furnace replacement."

The Committee did not establish an initial standard for small gas furnaces in the statute and instead directed the DOE to establish the standard by rule at an annual fuel utilization efficiency of not less than 71 percent and not more than 78 percent. The Committee was concerned that setting a standard for small gas furnaces, at or near 78 percent (the level for larger gas furnaces), would increase their initial price. Because of the competition between small gas furnaces and electric resistance heating in some areas of the Nation, such a price increase for small gas furnaces could induce builders or consumers to switch to electric resistance hearing. No specific standard for electric resistance heating is included in this bill.

Section 325(j) provides additional safeguards against a standard for small gas furnaces being set at a level that results in a buying preference or significant switching from gas heating to electric resistance heating (see section-by-section analysis).

7. On page 49, line 5, delete the word "basis." and insert in lieu thereof "or equivalent cost basis." Section 327(f)(3) establishes the requirements which a State building code, concerning the efficiency of a covered product, must meet in order to avoid preemption upon enactment of a Federal standard. Section 327(f)(3)(C) requires that a credit to the energy consumption or conservation objective allowed by the code, for installing covered products having energy efficiencies exceeding the standard, be given in terms of energy use. The amendment is necessary because some State energy codes are based on energy costs, and not on an energy use. This amendment clarifies that such credits may also be based on equivalent energy cost. For example, Oregon's code *relies on total life-cycle* costs for building construction and operation. Thus, the legislation, as amended, would allow tradeoffs between components based either on their energy usage or equivalent energy costs; including the appliances' initial purchase cost and operating costs, but excluding subsidies or rebates. This construction parallels section 327(f)(3)(F), which allows energy objectives to be specified in either energy use or energy cost terms.

SECTION-BY-SECTION ANALYSIS

Section 1 entitled the "National Appliance Energy Conservation Act" (the "Act").

Section 2 (definitions) amends section 321(a) of the Energy Policy and Conservation Act ("EPCA") by adding definitions which are required to implement the specific standards provisions and other provisions added to EPCA by the Act. Section 2(a) defines "energy conservation standard" to include the performance standards set forth in the Act as well as the design requirements. Section 2(b) defines the technical terms that are used in the standards.

Section 3 (Coverage) amends section 332(a) of EPCA, listing the products that are covered by the Act. These products are: refrigerators; refrigerator-freezers; freezers; room air conditioners; central air conditioners and central air conditioning heat pumps; central air conditioners and central air conditioning heat pumps; water

heaters; pool heaters; direct heating equipment; furnaces; dishwashers; clothes washers; clothes dryers; television sets and kitchen ranges and ovens. Other consumer products may be regulated by the Secretary under existing section 322(b) of EPCA. Consumer products designed solely for use in recreational vehicles and other mobile equipment are not covered by the Act.

Section 4 (Test Procedures): Section 323 of EPCA is amended so as to conform with the establishment of specific standard levels in the Act. New section 323(a) states that all test procedures and related determinations prescribed or made by the Secretary with respect to any covered product, which are in effect on the date of enactment of the Act, remain in effect until the Secretary amends the test procedures and related determinations.

New section 323(b) authorizes the Secretary, with the assistance of the National Bureau of Standards, to amend existing test procedures, or to prescribe new test procedures for any covered product for which there are no test procedures. If the Secretary determines that a test procedure should be prescribed or amended, he shall promptly publish in the Federal Register proposed test procedures and afford interested parties an opportunity for comment. The Act extends the comment period to a minimum of 60 days (compared to 45 days under current law) and allows the Secretary to extend this comment period to as much as 270 days for good cause shown.

New section 323(c) modifies existing law regarding the restrictions on certain representations in writing or in broadcast advertisements about the energy characteristics of covered products.

New section 323(d) restates existing law with minor revisions regarding cases in which test procedures are not required.

New section 323(e) addresses the steps the Secretary must take to conform an energy conservation standard to an amended test procedure in the event a test procedure is amended.

Section 5 (Energy Conservation Standard): This section significantly amends existing Section 325 of EPCA by establishing the specific initial energy conservation standards for the covered products (with the exception of televisions and small gas furnaces), and by requiring future rulemakings under mandatory schedules and revised criteria.

Under each subsection, a minimum duration period (i.e., the period between the effective date of standards and the dates of possible revisions thereto) is prescribed for each initial and revised standard. Manufacturers are also given specified lead times (i.e., the time between final publication of a revised standard by DOE and the effective date of the revised standard) within which to redesign their products to comply with new standards.

New section 325(a) contains the purpose of this section.

New section 325(b) contains the initial standard levels for refrigerators, refrigerator-freezers and freezers.

New sections 325(c) through 325(h) contain the initial standard levels and applicable dates for, respectively: room air conditioners (section 325(c)); central air conditioners and central air conditioning heat pumps (section 325(d)), water heaters, pool heaters, and direct heating equipment (section 325(e)); furnaces (section 325(f)); dishwashers, clothes washers and clothes dryers (section 325(g)); kitchen ranges and ovens (section 325(h)); and television sets (section 325(i)(3)).

New section 325(i), which essentially restates existing law, allows the Secretary in his discretion to promulgate standards for additional products, and specifies that a 5-year lead time is required between the publication of a final rule and the effective date of the standards. The subsection explicitly permits the Secretary to prescribe an energy conservation standard for television sets but such a standard may not become effective with respect to products manufactured before January 7, 1992.

New section 325(j) establishes the criteria by which the Secretary may prescribe new or amended standards. The Secretary may not increase the maximum allowable energy use or decrease the minimum required energy efficiency of a covered product.

This section retains the requirements of existing law that energy conservation standards, including new or amended standards, shall be designed to achieve the maximum improvement in energy efficiency which the Secretary determines is "technologically feasible" and "economically justified."

With respect to the small gas furnace, it is the Committee's intent that should the Secretary determine that significant switching is occurring as a result of the small gas furnace standard, then he has the authority to review the standard and through a rulemaking establish a new standard, otherwise consistent with this Act, which the Secretary determines will avoid such switching. Obviously, in this case, the Secretary is authorized to lower an energy conservation standard notwithstanding section 325(j)(1), but he may not lower the standard below 71 percent.

This section also modifies the requirements of existing law regarding the Secretary's evaluation of the technological feasibility and economic justification of a proposed standard. For example, the section creates a statutory rebuttable presumption that a new or amended standard level is economically justified if the Secretary makes certain findings.

New section 325(j)(4) also prohibits the Secretary from prescribing a new or amended standard if he finds that the standard is likely to result in the unavailability in the United States in any covered product type or class of performance characteristics (including reliability), features, sizes, etc.

With respect to the small gas furnace standard (section 325(f)(1)(B)), the Secretary must consider the impact of any lessening of competition that is likely to result from the establishment of a standard for small furnaces. He must consider the economic impact of the standard on manufacturers and consumers. In addition, the Secretary must consider the total projected amount of energy savings likely to result from the establishment or revision of a standard for small furnaces.

Finally, section 325(j)(4) forbids a standard being set so as to result in the unavailability in the United States in any covered product type (or class) of performance characteristics, such as size or capacity. This paragraph, upon a sufficient showing, would forbid a standard for small gas furnaces being set at a level that would increase the price to the point that the product would be

noncompetitive and that would result in minimal demand for the product.

New subsection 325(k) contains procedures for prescribing new or amended standards. This section increases to 60 days (versus 45 days in current law) the public comment period on an advanced notice of proposed rulemaking and on proposed rules. It also provides that an amended or new final rule shall be published as soon as practicable but not less than 90 days after the publication of the proposed rule in the Federal Register. In other respects, this subsection essentially retains the requirements of current law.

Subsections (l), (m) and (o) are essentially identical to subsections (f), (j) and (e), respectively, or current law.

Subsection (n) states that compliance with the performance standards either set forth in or required by section 325 shall be determined using the test procedures and compliance criteria of section 323.

Section 6 (Requirements of Manufacturers): Section 326(d) of EPCA is amended to add a requirement that the Secretary shall consider existing public sources of information including nationally-recognized certification programs of trade associations. The Secretary is also required to exercise his authority in a manner designed to minimize unnecessary burdens on manufacturers of covered products.

Section 7 (Effect on Other Laws): Section 327 of EPCA is amended to create new preemption provisions, including criteria under which States can receive waivers from preemption.

Section 327(a), which essentially restates existing law, and provides that the Act supersedes State and local regulations regarding testing and labeling in certain cases.

New section 327(b) describes how preemption would apply during the period between the date of enactment of the Act and the effective dates of each Federal energy conservation standard. As a general principle, no State appliance efficiency regulations or requirements shall be applicable unless such regulations or requirement are prescribed or enacted before January 8, 1987, and are applicable to products before January 3, 1988. The section also lists other exceptions to preemption.

New section 327(c) states that on the effective date for each Federal energy conservation standard, that standard preempts State regulation, as provided under current law. This preemption is subject to the certain exceptions for building codes in new section 327(f), a state procurement regulation described in subsection (e), a regulation prohibiting constant burning pilot light for pool heaters, and any waiver from preemption granted by DOE upon State petition.

New section 327(d) allows States to file petitions seeking waiver of Federal preemption. This subsection provides new and more stringent criteria that a State must establish by a preponderance of the evidence in order to receive an exemption. The State is required to show that its regulation is needed to meet "Unusual and compelling" State or local interests.

New subsection (d) also provides that even if the State has made a showing of an unusual and compelling interest, the Secretary may not grant the requested waiver if he finds that interested persons have established by a preponderance of the evidence that such State regulation will significantly burden marketing, manufacturing, distribution, sale or servicing of the covered products or is likely to result in the unavailability in the State of any covered product type (or class) of performance characteristics that are substantially the same as those generally available in the State at the time of the Secretary's finding.

New subsection 327(d) further provides that any State regulation for which a waiver is granted shall apply to products manufactured three years after the rule granting such exemption is published in the Federal Register; however, the Secretary may lengthen the time to 5 years if he finds that additional time is necessary for retooling, redesign, etc.

In general, no State regulation, except as specified in subsection (b), may go into effect prior to the earliest possible effective date established by the Act for a revision of the energy conservation standard. However, a State may implement its regulation before that date if it can show by a preponderance of the evidence that an "energy emergency condition" exists within the State.

This subsection further provides that any interested person may file a petition requesting the Secretary to withdraw the rule issued with respect to a waiver petition.

Section 327(e) provides that State or local procurement standards more stringent than the Federal energy conservation standards are not superseded by the part. This provision is substantially the same as section 327(c) of current law.

New section 327(f) describes Federal preemption with regard to energy efficiency or energy use requirements regarding covered products contained in State and local building codes for construction. State and local building codes governing new construction typically regulate the energy efficiency of central heating and cooling equipment and water heaters. This section states that energy efficiency or use requirements contained in State or local building codes enacted or prescribed before January 8, 1987 are not preempted until the effective date of the Federal energy conservation standard. Such requirements adopted on or after January 8, 1987, are not preempted if they do not require the energy efficiency of a covered product to exceed the standard set forth in a "national voluntary consensus standard"; or in a grandfathered State standard or standard for which a State waiver has been obtained, whichever is higher. National voluntary consensus standards include those adopted by the Association of Air Conditioning, Heating and Refrigerating Engineers (ASHRAE), which sets energy efficiency standards using procedures sanctioned by the American National Standards Institute. ASHRAE standards are adopted by most States and local building codes.

Section 327(f)(3) describes the preemption of States or local building codes that exists after the effective date of the initial Federal standard for a covered product.

This paragraph describes the requirements that must be met in order for State or local building codes not to be preempted after such effective date. The paragraph, therefore, allows a State flexibility to implement performance-based codes. These codes authorize builders to adjust or trade off the efficiencies of the various building components so long as an energy objective is met.

In order to avoid preemption of its building code provisions concerning covered products, this paragraph also requires States building codes which establish "credits" for various conservation measures, to provide, to the greatest degree possible, one-for-one equivalency between the energy efficiency of these differing measures and the credits provided for such energy efficiency. The Committee recognizes that in some cases, exact equivalency is not possible. For example, some conservation measures may only be available to the builder in discreet levels of energy efficiency, such as insulation which is available only in certain thicknesses. It is the Committee's intent, however, that State building codes follow a one-for-one equivalency as closely as possible, to assure that the credits for exceeding Federal standards are even-handed and are not unfairly weighted resulting in undue pressure on builders to install covered products exceeding Federal standards.

The limited requirements of this paragraph are designed to ensure tht performance-based building codes cannot circumvent the federal standard for a given covered product by effectively requiring the installation of such product with an efficiency exceeding the applicable Federal standards or State standards for which a waiver from preemption has been obtained. Finally, paragraph (4) states that a State or local government is not required to submit a petition to the Secretary in order to enforce or apply its building code, unless the building code requires the installation of covered products with efficiencies exceeding both the applicable Federal standard and any applicable State standard that has been granted a waiver from preemption.

Subsection (g) states that no disclosure under this part creates an expressed or implied warranty under State or federal law regarding energy efficiency.

Section 8 (Citizen Status): Section 335(a) of EPCA is amended by adding a Federal cause of action against the Secretary for failing to comply with the nondiscretionary duty to issue a proposed or final rule according to the schedule in new Section 325 of EPCA. The courts are required to advance any such cases on the docket and to expedite the disposition of such cases. Jurisdiction is provided for the court to order appropriate relief, including relief that ensures the Secretary's compliance with future deadlines for that covered product.

Section 9 (Administrative Review and Judicial Review): Section 336 of EPCA remains essentially the same except for minor amendments. In addition, new subsection (c) states that jurisdiction is vested in Federal district courts over actions brought by any adversely affected person to determine whether a State of local government is complying with section 327 of this Act. This provision allows persons to seek declaratory judgments that State building codes do not comply with the criteria in the Act. The provision is necessary because the Act does not require States to petition DOE to show that their building codes comply with Section 327(f).

Section 10 (Annual Report): Section 338 of EPCA is amended by adding at the end a statement that nothing in the Section provides a defense or justification for a failure by the Secretary to comply with a nondiscretionary duty.

Cost and Budgetary Considerations

The following estimate of costs of this measure has been provided by the Congressional Budget Office:

U.S. Congress,
Congressional Budget Office,
Washington, DC, January 29, 1987.

Hon. J. Bennett Johnston, Jr.,
Chairman, Committee on Energy and Natural Resources, U.S. Senate, Dirksen Senate Office Building, Washington, DC.

Dear Mr. Chairman: The Congressional Budget Office has reviewed S. 83, the National Appliance Energy Conservation Act of 1987, as ordered reported by the Senate Committee on Energy and Natural Resources, January 28, 1987.

S. 83 establishes energy conservation standards for categories of covered appliances. It provides a schedule for the Secretary of Energy to evaluate these standards to ensure that the maximum energy efficiency that is technologically feasible and economically justified is being achieved. This bill also provides for the preemption of state energy conservation appliance standards after the federal standards are in effect.

CBO estimates that S. 83 will have no significant impact on government spending for fiscal years 1988 through 1992. The Department of Energy currently plans to conduct technical and economic evaluations of appliances on essentially the same schedule described in S. 83.

Enactment of this bill would not directly affect the budgets of state or local governments.

If you wish further details on this estimate, we will be pleased to provide them.

With best wishes,
Sincerely,

Edward Gramlich,
(for Rudolph G. Penner, Director).

Regulatory Impact Evaluation

Under existing law the Department of Energy is required to implement a Federal energy conservation program for home appliances. S. 83 would amend existing law and decrease the number of regulations associated with others. On balance, however, the net effect of S. 83 would be a reduction in regulations resulting from the existing program.

S. 83 eliminated the need for certain regulations. For example, S. 83 would substantially reduce the regulatory and economic burdens of the Federal appliance energy conservation program on the appliance manufacturing industry by reducing appliance regulation at the State level. The bill increases Federal preemption of State regulation. As a result, industry would avoid the burdens of a patchwork of conflicting and unpredictable State regulations. In addition, S. 83 establishes energy conservation standards for applicance

types which, without enactment of the measure, would be required to be established through more costly regulatory procedures conducted by the Department.

S. 83 would, on the other hand, increase regulations in other areas by requiring greater State and local compliance with the Federal program. For Example, S. 83 would establish two procedures under which a State may petition for a waiver from Federal preemption of State appliance efficiency regulations. Currently, there is only one petition procedure. Additionally, S. 83 would establish a new regulatory requirement that State building codes must comply with certain requirements of the Federal appliance energy conservation program in order to avoid preemption. These compliance provisions of S. 83 increase the regulatory burden for States which, under current law, are free to develop and promulgate building codes without regard to the Federal appliance energy conservation program.

Although it is not possible to quantify the areas in which regulations are increased or decreased by S. 83, an evaluation of such areas clearly demonstrates that the net effect of the measure would be to reduce, rather than increase, regulations and economic costs. Moreover, the Congressional Budget Office estimates a net reduction in Federal Government costs over the next 3 fiscal years as a result of passage of this legislation. In addition, there is a strong consensus within the appliance manufacturing industry that the measure would reduce the industry's economic and regulatory burdens.

Executive Communications

The Committee has received no reports or communications relating to S. 83.

Changes in Existing Law

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, changes in existing law made by the bill, S. 83, as ordered reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new matter is printed in italic, existing law in which no change is proposed is shown in roman):

Energy Policy and Conservation Act

* * * * * * *

TITLE III—IMPROVING ENERGY EFFICIENCY

* * * * * * *

Part B—Energy Conservation Program for Consumer Products Other Than Automobiles

DEFINITIONS

Sec. 321. (a) For purposes of this part:

(1)* * *

* * * * * * *

[(6) The term "energy efficiency standard" means a performance standard—

[(A) which prescribes a minimum level of energy efficiency for a covered product, determined in accordance with test procedures prescribed under section 323, and

[(B) which includes any other requirements which the Secretary may prescribe under section 325(c).]

(6) The term "energy conservation standard" means—

(A) a performance standard which prescribes a minimum level of energy efficiency or a maximum quantity of energy use for a covered product, determined in accordance with test procedures prescribed under section 323; or

(B) a design requirement for the products specified in paragraphs (6), (7), (8), (10), and (12) of section 322(a); and includes any other requirements which the Secretary may prescribe under section 325(m).

* * * * * * *

(19) The term "AV" is the adjusted volume for refrigerator, refrigerator-freezers, and freezers, as defined in the applicable test porcedure prescribed in section 323.

(20) The term "annual fuel utilization efficiency" means the efficiency descriptor for furnaces and boilers, determined using test procedures prescribed under section 323 and based on the assumption that all—

(A) weatherized warm air furnaces or boilers are located out-of-doors;

(B) warm air furnaces which are not weatherized are located indoors and all combustion and ventilation air is admitted through grills or ducts from the outdoors and does not communicate with air in the conditioned space; and

(C) boilers which are not weatherized are located within the heated space.

(21) The term "central air conditioner" means a product, other than a packaged terminal air conditioner, which—

(A) is powered by single phase electric current;

(B) is air-cooled;

(C) is rated below 65,000 Btu per hour;

(D) is not contained within the same cabinet as a furnace the rated capacity of which is above 125,000 Btu per hour; and

(E) is a heat pump or a cooling only unit.

(22) The term "efficiency descriptor" means the ratio of the useful output to the total energy input, determined using the test procedures prescribed under section 323 and expressed for the following products in the following terms:

(A) For furnaces and direct heating equipment, annual fuel utilization efficiency.

(B) For room air conditioners, energy efficiency ratio.

(C) For central air conditioning and central air conditioning heat pumps, seasonal energy efficiency ratio.

(D) For water heaters, energy factor.

(E) For pool heaters, thermal efficiency.

(23) The term "furnace" means a product which utilizes only single-phase electric current, or single-phase electric current or DC current in conjunction with natural gas, propane, or home heating oil, and which—

(A) is designed to be the principal heating source for the living space of a residence;

(B) is not contained within the same cabinet with a central air conditioner whose rated cooling capacity is above 65,000 Btu per hour;

(C) is an electric central furnace, electric boiler, forced-air central furnace, gravity central furnace, or low pressure steam or hot water boiler; and

(D) has a heat input rate of less than 300,000 Btu per hour for electric boilers and low pressure steam or hot water boilers and less than 225,000 Btu per hour for forced-air central furnaces, gravity central furnaces, and electric central furnaces.

(24) The terms "heat pump" or "reverse cycle" mean a product, other than a packaged terminal heat pump, which—

(A) consists of one or more assemblies;

(B) is powered by single phase electric current;

(C) is rated below 65,000 Btu per hour;

(D) utilizes an indoor conditioning coil, compressors, and refrigerant-to-outdoor-air heat exchanger to provide air heating; and

(E) may also provide air cooling, dehumidifying, humidifying circulating, and air cleaning.

(25) The term "pool heater" means an appliance designed for heating nonpotable water contained at atmospheric pressure, including heating water in swimming pools, spas, hot tubs and similar applications.

(26) The term "thermal efficiency of pool heaters" means a measure of the heat in the water delivered at the heater outlet divided by the heat input of the pool heater as measured under test conditions specified in section 2.8.1 of the American National Standard for Gas Fired Pool Heaters, Z21.56–1986, or as may be prescribed by the Secretary.

(27) The term "water heater" means a product which utilizes oil, gas, or electricity to heat potable water for use outside the heater upon demand, including—

(A) storage type units which heat and store water at a thermostatically controlled temperature, including gas storage water heaters with an input of 75,000 Btu per hour or less, oil storage water heaters with an input of 105,000 Btu per hour or less and electric storage water heaters with an input of 12 kilowatts or less;

(B) instantaneous type units which heat water but contain no more than one gallon of water per 4,000 Btu per hour of input, including gas instantaneous water heaters with an input of 200,000 Btu per hour or less, oil instantaneous water heaters with an input of 210,000 Btu per hour

or less, and electric instantaneous water heaters with an input of 12 kilowatts or less; and

(C) heat pump type units, with a maximum current rating of 24 amperes at a voltage no greater than 250 volts, which are products designed to transfer thermal energy from one temperature level to a higher temperature level for the purpose of heating water, including all ancillary equipment such as fans, storage tanks, pumps, or controls necessary for the device to perform its function.

(28) The term "weatherized warm air furnace or boiler" means a furnace or boiler designed for installation outdoors, approved for resistance to wind, rain, and snow, and supplied with its own venting system.

COVERAGE

[SEC. 322. (a) A consumer product is a covered product if it is one of the following types (or is designed to perform a function which is the principal function of any of the following types):

[(1) Refrigerators and refrigerator-freezers.
[(2) Freezers.
[(3) Dishwashers.
[(4) Clothes dryers.
[(5) Water heaters.
[(6) Room air conditioners.
[(7) Home heating equipment, not including furnaces.
[(8) Television sets.
[(9) Kitchen ranges and ovens.
[(10) Clothes washers.
[(11) Humidifiers and dehumidifiers.
[(12) Central air conditioners.
[(13) Furnaces.
[(14) Any other types of consumer product which the Secretary classifies as a covered product under subsection (b).]

COVERAGE

SEC. 322. (a) IN GENERAL.—The following consumer products, excluding those consumer products designed solely for use in recreational vehicles and other mobile equipment, are covered products:

(1) Refrigerators, refrigerator-freezers, and freezers which can be operated by alternating current electricity, excluding—

(A) any type designed to be used without doors; and

(B) any type which does not include a compressor and condenser unit as an integral part of the cabinet assembly.

(2) Room air conditioners.

(3) Central air conditioners and central air conditioning heat pumps.

(4) Water heaters.
(5) Furnaces.
(6) Dishwashers.
(7) Clothes washers.
(8) Clothes dryers.
(9) Direct heating equipment.
(10) Kitchen ranges and ovens.

(11) Pool heaters.
(12) Television sets.
(13) Any other type of consumer product which the Secretary classifies as a covered product under subsection (b).

[(b)(1)] (b) SPECIAL CLASSIFICATION OF CONSUMER PRODUCT.—(1) The Administrator may classify a type of consumer product as a covered product if he determines that—

(A) classifying products of such type as covered products is necessary or appropriate to carry out the purposes of this Act, and

(B) average annual per-househhold energy use by products of such type is likely to exceed 100 kilowatt-hours (or its Btu equivalent) per year.

* * * * * * *

[TEST PROCEDURES

[SEC. 323. (a)(1) The Secretary shall, during the 30-day period which begins on the date of enactment of this Act, afford interested persons an opportunity to present written data, views, and arguments with respect to the types specified in paragraphs (1) through (13) of section 32(a).

[(2) The Secretary shall direct the National Bureau of standards to develop test procedures for the determination of (A) estimated annual operating costs of covered products of the types specified in paragraph (1) through (13) of section 322(a), and (B) at least one other useful measure of energy consumption of such products which the Secretary determines is likely to assist consumers on making purchasing decisions.

[(3) The Secretary shall publish proposed test procedures with respect to all covered products of each of the types specified in paragraph (1) through (13) of section 322(a), and shall afford interested persons an opportunity to present oral and written data, views, and arguments with respect to such proposed test procedures. Such comment period shall not be less than 45 days.

[(4) The Secretary shall prescribe test procedures for the determination of (i) estimated annual operating costs of all covered products of each of the types specified in paragraphs (1) through (13) of section 322(a), and (ii) at least one other measure of energy consumption of such products which the Secretary determines is likely to assist consumers in making purchasing decisions. Except as provided in paragraph (6), such test procedures shall be prescribed not later than January 31, 1978.

[(5) If the Secretary has classified a type of product as a covered product under section 322(b), the Secretary may, after affording interested persons an opportunity to comment, direct the National Bureau of Standards to develop, and may publish proposed test procedures for such type of covered product (or class thereof). The Secretary shall afford interested persons an opportunity to present oral and written data, views and arguments with respect to such proposed test procedures. Such comment period shall not be less than 45 days. The Secretary may thereafter prescribe test procedures in accordance with subsection (b) of this section with respect to such type or class of product if the Secretary or the Commission determines that—

[(A) the application of subsection (c) to such type of covered product (or class thereof) will assist consumers in making purchasing decisions, or

[(B) labeling in accordance with section 324 will assist purchasers in making purchasing decisions.

[(6)(A) The Secretary may delay the prescription of test procedures under paragraph (4) for a type of covered product (or class thereof) if he determines that he cannot, within the applicable time period, prescribe test procedures applicable to such type (or class) which meet the requirements of subsection (b), and he submits to the Congress a report of such determination together with the reasons therefor, and also publishes such determination (and reasons) in the Federal Register. In any such case, he shall prescribe such test procedures as soon as practicable, but in no event later than 90 days after the date specified in paragraph (4).

[(B) The Secretary is not required to publish and prescribe test procedures under paragraphs (3) and (4) for a type of covered product (or class thereof) if he determines by rule that test procedures cannot be developed which meet the requirements of subsection (b) and publishes such determination in the Federal Register, together with the reasons thereof. For purposes of section 327, a determination under this subparagraph with respect to any type (or class) of covered product, while effective, shall have the same effect as would a standard prescribed for such type (or class) under section 325.

[(7)(A) In the case of—

[(i) any test procedure prescribed under this subsection; or

[(ii) any determination under paragraph (6) that a test procedure cannot be developed which meets the requirements of subsection (b);

the Secretary shall, not later than 3 years after the date of the enactment of this paragraph (and from time to time thereafter), conduct a reevaluation and, on this basis of such reevaluation, shall determine if such test procedure should be amended or such determination should be rescinded. In conducting such reevaluation, the Secretary shall take into account such information as he deems relevant, including technological developments relating to the energy efficiency of the type (or class) of covered products involved.

[(B) If the Secretary determines under subparagraph (A) that—

[(i) a test procedure should be amended, he shall promptly publish in the Federal Register proposed test procedures incorporating such amendments, or

[(ii) a determination under paragraph (6) should be rescinded, he shall promptly publish notice thereof in the Federal Register,

and afford interested persons an opportunity to present oral and written data, views, and arguments. Such comment period shall not be less than 45 days.

[(b)(1) Any test prodedures prescribed under this section shall be reasonably designed to produce test results which reflect energy efficiency, energy use, or estimated annual operating cost of a covered product during a representative average use cycle (as determined by the Secretary), and shall not be unduly burdensome to conduct.

[(2) if the test procedure is a procedure for determining estimated annual operating costs, such procedure shall provide that such costs shall be calculated from measurements of energy use in a representative average-use cycle (as determined by the Secretary), and from representative average unit costs of the energy needed to operate such product during such cycle. The Secretary shall provide information to manufacturers respecting representative average unit costs of energy.

[(c)(1) Effective 180 days after a test procedure rule applicable to a covered product is prescribed under this section, no manufacturer, distributor, retailer, or private labeler may make any representation—

[(A) in writing (including a representation on a label), or

[(B) in any broadcast advertisement,

respecting the energy consumption of such product or cost of energy consumed by such product, unless such product has been tested in accordance with such test procedure and such representation fairly discloses the results of such testing.

[(2) On the petition of any manufacturer, distributor, retailer, or private labeler, filed not later than the 60th day before the expiration of the period involved, the 180-day period referred to in paragraph (1) may be extended by the Commission with respect to the petitioner (but in no event for more than an additional 180 days) if he finds that the requirements of paragraph (1) would impose on such petitioner an undue hardship (as determined by the Commission)]

TEST PROCEDURES

Sec. 323. (a) General Rule.—All test procedures and related determinations prescribed or made by the Secretary with respect to any covered product (or class thereof) which are in effect on the date of enactment of the National Applicance Energy Conservation Act of 1986 shall remain in effect until the Secretary amends such test procedures and related determinations under subsection (b).

(b) Amended and New Procedures.—(1)(A) The Secretary may amend test procedures with respect to any covered product if the Secretary determines that amended test procedures would more accurately or fully comply with the requirements of paragraph (3).

(B) The Secretary may, in accordance with the requirements of this subsection, prescribe test procedures for any consumer product classified as a covered product under section 322(b).

(C) The Secretary shall direct the National Bureau of Standards to assist in developing new or amended test procedures.

(2) If the Secretary determines, on his own behalf or in response to a petition by any interested person, that a test procedure should be prescribed or amended, the Secretary shall promptly publish in the Federal Register proposed test procedures and afford interested persons an opportunity to present oral and written data, views, and arguments with respect to such procedures. The comment period shall not be less than 60 days and may be extended for good cause shown to not more than 270 days. In prescribing or amending a test proce-

dure, the Secretary shall take into account such information as the Secretary determines relevant to such procedure, including technological developments relating to energy use or energy efficiency of the type (or class) of covered products involved.

(3) Any test procedures prescribed or amended under this section shall be reasonably designed to produce test results which measure energy efficiency, energy use, or estimated annual operating cost of a covered product during a representative average use cycle or period of use, as determined by the Secretary, and shall not be unduly burdensome to conduct.

(4) If the test procedure is as procedure for determining estimated annual operating costs, such procedure shall provide that such costs shall be calculated from measurements of energy use in a representative average use cycle or period of use, ad determined by the Secretary, and from representative average unit costs of the energy needed to operate such product during such cycle. The Secretary shall provide information to manufacturers with respect to representative average unit costs of energy.

(c) Restriction on Certain Representations.—(1) No manufacturer, distributor, retailer, or private labeler may make any representation—

(A) in writing (including a representation on a label); or

(B) in any broadcast advertisement,

with respect to the energy use or efficiency of a covered product to which a test procedure is applicable under subsection (a) or the cost of energy consumed by such product, unless such product has been tested in accordance with such test procedure and such representation fairly discloses the results of such testing.

(2) Effective 180 days after an amended or new test procedure applicable to a covered product is prescribed under subsection (b), no manufacturer, distributor, retailer, or private labeler may make any representation—

(A) in writing (including a representation on a label); or

(B) in any broadcast advertisement, with respect to energy use or efficiency of such product or cost of energy consumed by such product, unless such product has been tested in accordance with such amended or new test procedures and such representation dairly discloses the results of such testing.

(3) On the petition of any manufacturer, distributor, retailer, or private labeler, filed not later than the 60th day before the expiration of the period involved, the 180-day period referred to in paragraph (2) may be extended by the Secretary with respect to the petitioner (but in no event for more than an additional 180 days) if the Secretary determines that the requirements of paragraph (2) would impose an undue hardship on such petitioner.

(d) Case in Which Test Procedure Is Not Required.—(1) The Secretary is not required to publish and prescribe test procedures for a covered product (or class thereof) if the Secretary determines, by rule, that test procedures cannot be developed which meet the requirements of subsection (b)(3) and publishes such determination in the Federal Register, together with the reasons therefor.

(2) For purposes of section 327, a determination under paragraph (1) with respect to any covered product or class shall have the same affect as would a standard prescribed for a covered product (or class).

(e) Amendment of Standard.—(1) In the case of any amended test procedure which is prescribed pursuant to this section, the Secretary shall determine, in the rulemaking carried out with respect to prescribing such procedure, to what extent, if any, the proposed test procedure would alter the measured energy efficiency or measured energy use of any covered product as determined under the existing test procedure.

(2) If the Secretary determines that the amended test procedure will alter the measured efficiency or measured use, the Secretary shall amend the applicable energy conservation standard during the rulemaking carried out with respect to such test procedure. In determining the amended energy conservation standard, the Secretary shall measure, pursuant to the amended test procedure, the energy efficiency or energy use of a representative sample of covered products that minimally comply with the existing standard. The average of such energy efficiency or energy use levels determined under the amended test procedure shall constitute the amended energy conservation standard for the applicable covered products.

(3) Models of covered products in use before the date on which the amended energy conservation standard becomes effective (or revisions of such models that come into use after such date and have the same energy efficiency or energy use characteristics) that comply with the energy conservation standard applicable to such covered products on the day before such date shall be deemed to comply with the amended energy conservation standard.

(4) The Secretary's authority to amend energy conservation standards under this subsection shall not affect the Secretary's obligation to issue final rules as described in section 325.

LABELING

Sec. 324. **[**(a)(1)**]** *(a) In General.—(1)* The Commission shall prescribe labeling rules under this section applicable to all covered products of each of the types specified in paragraphs (1) **[**through (9)**]**, *(2), (4), (6), and (8) through (11)* of section 322(a), except to the extent that, with respect to any such type (or class thereof), the Commission determines under the second sentence of subsection (b)(5) that labeling in accordance with this section is not technologically or economically feasible.

* * * * * * *

(2) The Commission shall prescribe labeling rules under that section applicable to all covered products to each of the types specified in paragraphs **[**(10 through (13)**]** *(3), (5), and (7)* of section 322(a), except to the extent that with respect to any such type (or class thereof), the Commission determines under the second sentence of subsection (b)(5) that labeling in accordance with this section is not technologically or economically feasible or is not likely to assist consumers in making purchasing decisions.

(3) The Commission may prescribe a labeling rule under this section applicable to covered products of a type specified in paragraph **[**(14)**]** *(12)* of section 322(a) (or a class thereof) if—

[(A) the Commission or the Secretary has made a determination with respect to such type (or a class thereof) under section 323(a)(5)(B),]

(A) the Commission or the Secretary has made a determination with respect to such type (or class thereof) that labeling in accordance with this section will assist purchasers in making purchasing decisions,

(B) The Secretary has prescribed test procedures under section [323(a)(5)] *323(b)(1)(B)* for such type (or class thereof), and

(C) the Commission determines with respect to such type (or class thereof) that application of labeling rules under this section to such type (or class thereof) is economically and technologically feasible.

* * * * * * *

[(b)(1) Not later than 30 days after the date on which a proposed test procedure applicable to a covered product of any of the types specified in paragraphs (1) through (14) of section 322(a) (or class thereof) is published under section 323(a), the Commission shall publish a proposed labeling rule applicable to such type (or class thereof).]

(b) RULES IN EFFECT; RULES.—(1)(A) Any labeling rule in effect on the date of the enactment of the National Appliance Energy Conservation Act of 1986 shall remain in effect until amended, by rule, by the Commission.

(B) After the date of the enactment of the National Appliance Energy Conservation Act of 1986 and not later than 30 days after the date on which a proposed test procedure applicable to a covered product of any of the types specified in paragraphs (1) through (12) of section 322(a) (or class thereof) is prescribed under section 323(b), the Commission shall publish a proposed labeling rule applicable to such type (or class thereof).

* * * * * * *

(3) Not earlier than 45 days nor later than 60 days after the date on which test procedures are prescribed under section 323(b) with respect to covered products of any type (or class thereof) specified in paragraphs (1) through [(13)] *(11)* of section 322(a), the Commission shall prescribe labeling rules with respect to covered products of such type (or class thereof). Not earlier than 45 days after the date on which test procedures are prescribed under section 323(b) with respect to covered products of a type specified in paragraph [(14)] *(12)* of section 322(a), the Commission may prescribe labeling rules with respect to covered products of such type (or class thereof).

* * * * * * *

(5) The Commission may delay the publication of a proposed labeling rule, or the prescription of a labeling rule, beyond the dates specified in paragraph (1) or (3), if it determines that it cannot publish proposed labeling rules or prescribe labeling rules which meet the requirements of this section on or prior to the date specified in the applicable paragraph and publishes such determination in the Federal Register, together with the reasons therefor. In any such case, it shall publish proposed labeling rules or prescribe labeling rules for covered products of such type (or class thereof) as soon as practicable unless it determines (A) that labeling in accordance with this section is not economically or technically feasible, or (B) in the case of a type specified in paragraphs [(10) through (13)] *(3), (5), and (7)* of section 322(a), that labeling in accordance with this section is not likely to assist consumers in purchasing decisions. Any such determination shall be published in the Federal Register, together with the reasons therefor. This paragraph shall not apply to the prescription of a labeling rule with respect to covered products of a type specified in paragraph [(14)] *(12)* of section 322(a).

[(c)(1)] *(c) CONTENT OF LABEL.—(1)* Subject to paragraph (6), a rule prescribed under this section shall require that each covered product in the type or class of covered products to which the rule applies bear a label which discloses—

(A) the estimated annual operating cost of such product (determined in accordance with test procedures prescribed under section 323), except that it—

(i) the Secretary determines that disclosure of estimated annual operating cost is not technologically feasible, or

(ii) the Commission determines that such disclosure is not likely to assist consumers in making purchasing decisions or is not economically feasible,

the Commission shall require disclosure of a different useful measure of energy consumption (determined in accordance with test procedures prescribed under section 323); and

(B) information respecting the range of estimated annual operating costs for covered products to which the rule applies; except that if the Commission requires disclosure under subparagraph (A) of a measure of energy consumption different from estimated annual operating cost, then the label shall disclose the range of such measure of energy consumption of covered products to which such rule applies.

* * * * * * *

[(d)] *(d) EFFECTIVE DATE.*—A rule under this section (or an amendment thereto) shall not apply to any covered product the manufacture of which was completed prior to the effective date of such rule or amendment, as the case may be.

[(e)] *(e) STUDY OF CERTAIN PRODUCTS.*—The Secretary, in consultation with the Commission, shall study consumer products for which labeling rules under this section have not been proposed, in order to determine (1) the aggregate energy consumption of such products, and (2) whether the imposition of labeling requirements under this section would be feasible and useful to consumers in marketing purchasing decisions. The Secretary shall include the results of such study in the annual report under section 338.

(f) CONSULTATION.—The Secretary and the Commission shall consult with each other on a continuing basis as may be necessary or appropriate to carry out their respective responsibilities under this part. Before the Commission makes any determination under subsection (a)(1) [or (2)], it shall obtain the views of the Secretary and shall take such views into account in making such determination.

(g) *Other Authority of the Commission.*—Until such time as labeling rules under this section should take effect with respect to a type or class of covered product, this section shall not affect any authority of the Commission under the Federal Trade Commission Act to require labeling with respect to energy consumption of such type or class of covered product.

[ENERGY EFFICIENCY STANDARDS

[Sec. 325. (a)(1) The Secretary shall, by rule; prescribe an energy efficiency standard for each type (or class) of covered products specified in paragraphs (1) through (13) of section 322(a).

[(2) The Secretary may, by rule, prescribe an energy efficiency standard for any type (or class) of covered products of a type specified in paragraph (14) of section 322(a), if he determines, for the purposes of this section, that—

[(A) the average per household energy use within the United States by products of such type (or class) exceeded 150 kilowatt-hours (or its Btu equivalent) for any 12-calendar-month period ending before such determination;

[(B) the aggregate household energy use within the United States by products of such type (or class) exceeded 4,200,000,000 kilowatt-hours (or its Btu equivalent) for any such 12-calendar-month period;

[(C) substantial improvement in the energy efficiency of products of such type (or class) is technologically feasible; and

[(D) the application of a labeling rule under section 324 to such type (or class) is not likely to be sufficient to induce manufacturers to produce, and consumers and other persons to purchase, covered products of such type (or class) which achieve the maximum energy efficiency which is technologically feasible to attain and is economically justified.

Not later than 2 years after the date of the enactment of this paragraph, the Secretary shall publish in the Federal Register a list of those types (or classes) of covered products which he considers may be subject to standards authorized to be prescribed under this paragraph. The Secretary may revise such list from time to time thereafter.

[(b) No standard for a type (or class) of covered products shall be prescribed pursuant to subsection (a) if—

[(1) a test procedure has not been prescribed pursuant to section 323 with respect to that type (or class) of products, or

[(2) the Secretary determines, by rule, that the establishment of such standard will not result in significant conservation of energy or that the establishment of such standard is not technologically feasible or economically justified.

For purposes of section 327, a determination under paragraph (2) with respect to any type (or class) of covered products shall have the same effect as would a standard prescribed for such type (or class) under this section.

[(c) Energy efficiency standards for each type (or class) of covered products prescribed under this section shall be designed to achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified. Such standards may be phased in, over a period not in excess of 5 years, through the establishment of intermediate standards, as determined by the Secretary.

[(d) Before determining whether a standard is economically justified under subsection (c), the Secretary, after receiving any views and comments furnished with respect to the proposed standard under section 336, shall determine that the benefits of the standard exceed its burdens based, to the greatest extent practicable, on a weighing of the following factors:

[(1) the economic impact of the standard on the manufacturers and on consumers of the product subject to such standard,

[(2) the savings in operating costs throughout the estimated average life of the covered products in the type (or class), compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered products which are likely to result from the imposition of the standard,

[(3) the total projected amount of energy savings likely to result directly from the imposition of the standard,

[(4) any lessening of the utility or the performance of the covered products likely to result from the imposition of the standard,

[(5) the impact of any lessening of competition determined in writing by the Attorney General that is likely to result from the imposition of the standard,

[(6) the need of the Nation to conserve energy, and

[(7) any other factors the Secretary considers relevant.

For purposes of paragraph (5), the Attorney General shall, not later than 60 days after publication of a proposed rule prescribing an energy efficiency standard, make a determination of the impact, if any, from any lessening of competition likely to result from such standard and transmit such determination in writing to the Secretary, together with an analysis of the nature and extent of such impact. Any such determination and analysis shall be published by the Secretary in the Federal Register.

[(e)(1) Subject to paragraph (2), the Secretary may, on application of any manufacturer, exempt such manufacturer from all or part of the requirements of any rule prescribing an energy efficiency standard under this section for any period which does not extend beyond the date which is 24 months after the date such rule is prescribed, if the Secretary finds that the annual gross revenues to such manufacturer for the preceding 12-month period from all its organizations (including the manufacture and sale of covered products) does not exceed $8,000,000. In making such finding in the case of any manufacturer, the Secretary shall take into account the annual gross revenues of any other person who controls, is controlled by, or is under common control with, such manufacturer.

[(2) The Secretary may not exercise the authority granted under paragraph (1) with respect to any type (or class) of covered product subject to any energy efficiency standard established under this section unless he makes a finding, after obtaining the written views of the Attorney General, that a failure to allow an exemption under paragraph (1) would likely result in a lessening of competition.

[(f)(1) A rule prescribing an energy efficiency standard for a type (or class) of covered products shall specify a level of energy efficiency higher or lower than that which applies (or would apply) for such type (or class) for any group of covered products which have the same function or intended use, if the Secretary, in his discretion determines that covered products within such group—

[(A) consume a different kind of energy from that consumed by other covered products within such type (or class), or

[(B) have a capacity or other performance-related feature which other products within such type (or class) do not have, justifying a higher or lower standard from that which applies (or will apply) to other products within such type (or class). In determining under this paragraph whether a performance-related feature justifies the establishment of a higher or lower standard, the Secretary shall consider such factors as the utility to the consumer of such a feature, and such other factors as he deems appropriate.

[(2) Any rule prescribing a higher or lower level of energy efficiency under paragraph (1) shall include an explanation of the basis on which such higher or lower level was established.

[(g) In prescribing energy efficiency standards under this section, the Secretary shall give priority to the establishment of energy efficiency standards for types of products (or classes thereof) specified in paragraphs (1), (2), (4), (5), (6), (7), (9), (12), and (13) of section 322(a).

[(h)(1) Not later than 5 years after prescribing an energy efficiency standard until this section (and from time to time thereafter), the Secretary shall—

[(A) conduct a reevaluation in order to determine whether such standard should be amended in any manner, and

[(B) make, and publish in the Federal Register, such determination.

In conducting such reevaluation, the Secretary shall take into account such information as he deems relevant including technological development, and the economic impact of the standard.

[(2) If the Secretary determines under paragraph (1) that a standard should be amended, he shall promptly publish a proposed rule incorporating such amendments and afford interested persons an opportunity to present oral and written data, views, and arguments. Such comment period shall not be less than 45 days.

[(i) Any energy efficiency standard shall be prescribed in accordance with the following procedures.

[(1) The Secretary shall (A) publish an advance notice of proposed rulemaking which specifies the type (or class) of covered products to which the rule is likely to apply, and (B) invite interested persons to submit, within 45 days after the date of publication of such advance notice, written presentation of data, views and arguments relevant to establishing such an energy efficiency standard.

[(2) An advance notice of proposed rulemaking under paragraph (1) shall be published by the Secretary—

[(A) in the case of types of covered products (or classes thereof) of the types specified in paragraphs (1), (2), (4), (5), (6), (7), (9), (12), and (13) of section 322(a), not later than 30 days after a test procedure with respect to that type of covered products (or class thereof) has been prescribed, or 45 days after the date of the enactment of this subparagraph, whichever is later; and

[(B) in the case of types of covered products (or classes thereof) specified in paragraph (3), (8), (10), and (11), of section 322(a), not later than 30 days after a test procedure, with respect to that type (or class) of covered products has been prescribed, or one year after the date of the enactment of this subparagraph, whichever is later.

[(3) A proposed rule which prescribes an energy efficiency standard for a type (or class) of covered products may not be published earlier than 60 days after the date of publication of advance notice of proposed rulemaking for such type (or class). The Secretary shall determine the maximum improvement in energy efficiency that is technologically feasible for each type (or class) of covered products in prescribing such standard and if such standard is not designed to achieve such efficiency, the Secretary shall state in the proposed rule the reasons therefor. After the publication of such proposed rulemaking, the Secretary shall afford interested persons, in accordance with section 336, an opportunity to present oral and written comments (including an opportunity to question those who make such presentations, as provided in such section) on matters relating to such proposed rule, including—

[(A) whether the standard to be prescribed is economically justified (taking into account those factors which the Secretary must consider under subsection (d)),

[(B) whether the standard will achieve the maximum improvement in energy efficiency which is technologically feasible,

[(C) if the standard will not achieve such improvement, whether the reasons for not achieving such improvement are adequate, and

[(D) whether such rule should prescribe a level of energy efficiency which is higher or lower than that which would otherwise apply in the case of any group of products within the type (or class) to be subject to such standard.

[(4) A rule prescribing an energy efficiency standard for a type (or class) of covered products may not be published earlier than 60 days after the date of publication of the proposed rule under this section for such type (or class). Such rule shall be published as soon as practicable after such 60-day period, but in no event later than 2 years after publication of the advance notice. Such rule shall take effect not earlier than 180 days after the date of publication in the Federal Register. Such rule (or any amendment thereto) shall not apply to any covered products the manufacture of which was completed before the effective date of the rule or amendment as the case may be.

[(j) An energy efficiency standard prescribed under this section shall include tst procedures prescribed in accordance with section 323, and may include any requirement which the Secretary determines is necessary to assure that each covered product to which such standard applies meets the required minimum level of energy efficiency specified in such standard.]

ENERGY CONSERVATION STANDARDS

SEC. 325. (a) PURPOSES.—The purposes of this section are to—

(1) provide Federal energy conservation standards applicable to covered products; and

(2) authorize the Secretary to prescribe amended or new energy conservation standards for each type (or class) of covered product.

(b) STANDARDS FOR REFRIGERATORS, REFRIGERATOR-FREEZERS, AND FREEZERS.—(1) The following is the maximum energy use allowed in kilowatt hours per year for the following products (other than those described in paragraph (2)) manufactured on or after January 1, 1990:

	Energy Standards Equations
Refrigerators and Refrigerator-Freezers with manual defrost	16.3AV+316
Refrigerator-Freezers—partial automatic defrost	21.8 AV+429
Refrigerator-Freezers—automatic defrost with:	
Top mounted freezer without ice	23.5 AV+471
Side mounted freezer without ice	27.7 AV+488
Bottom mounted freezer without ice	27.7 AV+488
Top mounted freezer with through the door ice service	26.4 AV+535
Side mounted freezer with through the door ice	30.9 AV+547
Upright Freezers with:	
Manual defrost	10.9 AV+422
Automatic defrost	16.0 AV+623
Chest Freezers and all other freezers	14.8 AV+223

(2) The standards described in paragraph (1) do not apply to refrigerators and refrigerator-freezers with total refrigerated volume exceeding 39 cubic feet or freezers with total refrigerated volume exceeding 30 cubic feet.

(3)(A)(i) The Secretary shall publish a proposed rule, no later than July 1, 1988, to determine if the standards established by paragraph (1) should be amended. The Secretary shall publish a final rule no later than July 1, 1989, which shall contain such amendment, if any, and provide that the amendment shall apply to products manufactured on or after January 1, 1993. If such a final rule is not published before January 1, 1990, any amendment of such standards shall apply to products manufactured on or before January 1, 1995. Nothing in this subsection provides any justification or defense for a failure by the Secretary to comply with the nondiscretionary duty to publish final rules by the dates stated in this paragraph.

(ii)(I) If the Secretary does not publish a final rule before January 1, 1990, relating to the revision of the energy conservation standards for refrigerators, refrigerator-freezers and freezers, the regulations which established standards for such products and were promulgated by the California Energy Commission on December 14, 1984, to be effective January 1, 1992 (or any amendments to such standards that are not more stringent than the standards in the original regulations), shall apply in California to such products, effective beginning January 1, 1993, and shall not be preempted after such effective date by any energy conservation standard established in this section or prescribed, on or after January 1, 1990, under this section.

(II) If the Secretary does not publish a final rule before January 1, 1992, relating to the revision of the energy conservation standards for refrigerators, refrigerator-freeezers and freezers, State regulations which apply to such products manufactured on or after January 1, 1995, shall apply to such products until the effective date of a rule issued under this section with respect to such products.

(B) After the publication of a final rule under subparagraph (A), the Secretary shall publish a final rule no later than every five years after the date of publication of the previous final rule. The Secretary shall determine in such rule whether to amend the standards in effect for the products described in paragraph (1).

(C) Any amendment prescribed under subparagraph (B) shall apply to products manufactured after a date which is five years after—

(i) the effective date of the previous amendment; or

(ii) if the previous final rule did not amend the standards, the earliest date by which the previous amendment could have been effective;

except that in no case may any amended standard apply to products manufactured within three years after publication of the final rule establishing such amended standard.

(c) STANDARDS FOR ROOM AIR CONDITIONERS.—(1) The energy efficiency ratio of room air conditioners shall be not less than the following for products manufactured on or after January 1, 1990:

Product class	Ratio
Without Reverse Cycle and With Louvered Sides:	
Less than 6,000 Btu	8.0
6,000 to 7,999 Btu	8.5
8,000 to 13,999 Btu	9.0
14,000 to 19,999 Btu	8.8
20,000 and more Btu	8.2
Without Reverse Cycle and Without Louvered Sides:	
Less than 6,000 Btu	8.0
6,000 to 7,999 Btu	8.5
8,000 to 13,999Btu	8.5
14,000 to 19,999 Btu	8.5
20,000 and more Btu	8.2
With Reverse Cycle and With Louvered Sides	8.5
With Reverse Cycle, Without Louvered Sides	8.0

(2)(A) The Secretary shall publish a final rule no later than January 1, 1992, to determine if the standards established under paragraph (1) should be amended. Such rule shall contain such amendment, if any, and provide that the amendment shall apply to products manufactured on or after January 1, 1995.

(B) After January 1, 1992, the Secretary shall publich a final rule no later than every five years after the date of publication of a previous final rule. The Secretary shall determine in such rule whether to amend the standards in effect for room air conditioners.

(C) Any amendment prescribed under subparagraph (B) shall apply to products manufactured after a date which is five years after—

(i) the effective date of the previous amendment; or

(ii) if the previous final rule did not amend the standards, the earliest date by which a previous amendment could have been effective;

except that in no case may any amended standard apply to products manufactured within three years after publication of the final rule establishing such amended standard.

(d) Standards for Central Air Conditioners and Heat Pumps.—(1) The seasonal energy efficiency ratio of central air conditioners and central air conditioning heat pumps shall be not less than the following:

(A) Split Systems: 10.0 for products manufactured on or after January 1, 1992.

(B) Single Package Systems: 9.7 for products manufactured on or after January 1, 1993.

(2) The heating seasonal performance factor of central air conditioning heat pumps shall be not less than the following:

(A) Split Systems: 6.8 for products manufactured on or after January 1, 1992.

(B) Single Package Systems: 6.6 for products manufactured on or after January 1, 1993.

(3)(A) The Secretary shall publish a final rule no later than January 1, 1994, to determine whether the standards established under paragraph (1) should be amended. Such rule shall contain such amendment, if any, and provide that the amendment shall apply to products manufactured on or after January 1, 1999. The Secretary shall publish a final rule no later than January 1, 1994, to determine whether the standards established under paragraph (2) shall be amended. Such rule shall contain such amendment, if any, and provide that the amendment shall apply to products manufactured on or after January 1, 2002.

(B) The Secretary shall publish a final rule after January 1, 1994, and no later than January 1, 2001, to determine whether the standards in effect for central air conditioners and central air conditioning heat pumps should be amended. Such rule shall provide that any amendment shall apply to products manufactured on or after January 1, 2006.

(C) After January 1, 2001, the Secretary shall publish a final rule—

(i) no earlier than five years and no later than seven years after the date of publication of the previous final rule; or

(ii) if the previous final rule did not amend the standards, five years after the date of publication of the previous final rule.

The Secretary shall determine in such rule whether to amend the standards in effect for such products.

(D) Standards amended pursuant to subparagraph (C) shall apply only to products manufactured after a date which is—

(i) no earlier than five and no later than seven years after the effective date of the previous amendments; or

(ii) if the previous final rule did not amend the standard, five years after the earliest date by which a previous amendment could become effective;

except that in no case may any amended standard apply to products manufactured within five years after publication of the final rule prescribing such standard.

(e) Standards for Water Heaters; Pool Heaters; Direct Heating Equipment.—(1) The energy factor of water heaters shall be not less than the following for products manufactured on or after January 1, 1990:

(A) Gas Water Heater: .62−(.0019 × Rated Storage Volume in gallons)
(B) Oil Water Heater: .59−(.0019 × Rated Storage Volume in gallons)
(C) Electric Water Heater: .95−(.00132 × Rated Storage Volume in gallons)

(2) The thermal efficiency of pool heaters manufactured on or after January 1, 1990, shall not be less than 78 percent.

(3) The efficiencies of gas direct heating equipment manufactured on or after January 1, 1990, shall be not less than the following:

Wall	
Fan type	
Up to 42,000 Btu/hour	*73% AFUE*
Over 42,000 Btu/hour	*74% AFUE*
Gravity type	
Up to 10,000 Btu/hour	*59% AFUE*
Over 10,000 Btu/hour up to 12,000 Btu/hour	*60% AFUE*
Over 12,000 Btu/hour up to 15,000 Btu/hour	*61% AFUE*
Over 15,000 Btu/hour up to 19,000 Btu/hour	*62% AFUE*
Over 19,000 Btu/hour up to 27,000 Btu/hour	*63% AFUE*
Over 27,000 Btu/hour up to 46,000 Btu/hour	*64% AFUE*
Over 46,000 Btu/hour	*65% AFUE*
Floor	
Up to 37,000 Btu/hour	*56% AFUE*
Over 37,000 Btu/hour	*57% AFUE*
Room	
Up to 18,000 Btu/hour	*57% AFUE*
Over 18,000 Btu/hour up to 20,000 Btu/hour	*58% AFUE*
Over 20,000 Btu/hour up to 27,000 Btu/hour	*63% AFUE*
Over 27,000 Btu/hour up to 46,000 Btu/hour	*64% AFUE*
Over 46,000 Btu/hour	*65% AFUE*

(4)(A) The Secretary shall publish final rules no later than January 1, 1992, to determine whether the standards established by paragraphs (1), (2) or (3) for water heaters, pool heaters, and direct heating equipment should be amended. Such rule shall provide that any amendment shall apply to products manufactured on or after January 1, 1995.

(B) The Secretary shall publish a final rule no later than January 1, 2000, to determine whether standards in effect for such products should be amended. Such rule shall provide that any amendment shall apply to products manufactured on or after January 1, 2005.

(C) After January 1, 2000, the Secretary shall publish a final rule—

(i) no earlier than every five years and no later than every ten years after the date of publication of previous final rule; or

(ii) if the previous final rule did not amend the standards, five years in the date of publication of the previous final rule.

The Secretary shall determine in such whether to amend the standards in effect for such products.

(D) Such amended standards shall only apply to products manufactured after a date which is—

(i) no earlier than five years and no later than ten years after the effective date of the previous amendment; or

(ii) if the previous final rule did not amend the standard, five years after the earliest date by which the previous amendment could have become effective.

except that in no case may any amended standard apply to products manufactured within five years after publication of the final rule establishing such standard.

(f) Standards for Furnaces.—(1) Furnaces (other than furnaces designed solely for installation in mobile homes) manufactured on or after January 1, 1992, shall have an annual fuel utilization efficiency of not less than 78 percent, except that—

(A) boilers (other than gas steam boilers) shall have an annual fuel utilization efficiency of not less than 80 percent and gas steam boilers shall have an annual fuel utilization efficiency of not less than 68 percent; and

(B) the Secretary shall prescribe a final rule not later than January 1, 1989, establishing an energy conservation standard—

(i) which is for furnaces (other than furances designed solely for installation in mobile homes) having an input of less than 45,000 Btu per hour and manufactured on or after January 1, 1992;

(ii) which provides that the annual fuel utilization efficiency of such furnaces shall be a specific percent which is not less than 71 percent and not more than 78 percent; and

(iii) which the Secretary determines is not likely to result in a significant shift from gas heating to electric resistance heating with respect to either residential construction or furnace replacement.

(2) Furnaces which are designed solely for installation in mobile homes and which are manufactured on or after September 1, 1990, shall have an annual fuel utilization efficiency of not less than 75 percent.

(3)(A) The Secretary shall publish a final rule no later than January 1, 1992, to determine whether the standards established by paragraph (2) for mobile home furnaces should be amended. Such rule shall provide that any amendment shall apply to products manufactured on or after January 1, 1994.

(B) The Secretary shall publish a final rule no later than January 1, 1994, to determine whether the standards established by this subsection for furnaces (including mobile home furnaces) should be amended. Such rule shall provide that any amendment shall apply to products manufactured on or after January 1, 2002.

(C) After January 1, 1997 and before January 1, 2007, the Secretary shall publish a final rule to determine whether standards in effect for such products should be amended. Such rule shall contain such amendment, if any, and provide that any amendment shall apply to products manufactured on or after January 1, 2012.

(D) After the publication of the final rule described in subparagraph (C), the Secretary shall publish a final rule—

(i) no earlier than five years and later than ten years after the date of publication of the previous final rule; or

(ii) if the previous final rule did not amend the standards, five years after the date of publication of the previous final rule.

The Secretary shall determine in such rule whether to amend the standards effect for such products.

(E) Standards amended pursuant to subparagraph (D) shall apply only to products manufactured after a date which is—

(i) no earlier than five and no later than ten years after the effective date of the previous amendment; or

(ii) if the previous final rule did not amend the standard, five years after the earliest date by which the previous amendment could have become effective;

except that in no case may any amended standard apply to products manufactured within five years after publication of the final rule.

(g) Standards for Dishwashers; Clothes Washers; Clothes Dryers.—(1) Dishwashers manufactured on or after January 1, 1988, shall be equipped with an option to dry without heat.

(2) All rinse cycles of clothes washers shall include an unheated water option, but may have a heated water rinse option, for products manufactured on or after January 1, 1988.

(3) Gas clothes dryers shall not be equipped with a constant burning pilot for products manufactured on or after January 1, 1988.

(4)(A) The Secretary shall publish final rules no later than January 1, 1990, to determine if the standards established under this subsection for products described in paragraphs (1), (2), and (3) should be amended. Such rules shall provide that any amendment shall apply to products the manufacture of which is completed on or after January 1, 1993.

(B) After January 1, 1990, the Secretary shall publish a final rule no later than every five years after the date of publication of the previous final rule. The Secretary shall determine in such rule whether to amend the standards in effect for such products.

(C) Any such amendment shall apply to products manufactured after a date which is five years after—

(i) the effective date of the previous amendments; or

(ii) if the previous final rule did not amend the standard, the earliest date by which a previous amendment could have been in effect;

except that in no case may any amended standard apply to products manufactured within three years after publication of the final rule establishing such amended standard.

(h) Standards for Kitchen Ranges and Ovens.—(1) Gas kitchen ranges and ovens having an electrical supply cord shall not be equipped with a constant burning pilot for products manufactured on or after January 1, 1990.

(2)(A) The Secretary shall publish a final rule no later than January 1, 1992, to determine if the standards established for kitchen ranges and ovens in this subsection should be amended. Such rule shall contain such amendment, if any, and provide that the amendment shall apply to products manufactured on or after January 1, 1995.

(B) The Secretary shall publish a final rule no later than January 1, 1997, to determine whether standards in effect for such products should be amended. Such rule shall apply to products manufactured on or after January 1, 2000.

(C) After January 1, 1997, the Secretary shall publish a final rule no later than every five years after the date of publication of a previous final rule. The Secretary shall determine in such rule whether to amend the standards in effect for such product.

(D) Any amendment prescribed under subparagraph (C) shall apply to products manufactured after a date which is five years after—

(i) the effective date of the previous amendment; or

(ii) if the previous final rule did not amend the standard, the earliest date by which a previous amendment could have been in effect;

except that in no case may any amended standard apply to products manufactured within three years after publication of the final rule establishing such standard.

(i) Standard for Other Covered Products.—(1) The Secretary may prescribe an energy conservation standard for any type of (or class) of covered products of a type specified in paragraph (12) of section 322(a) if the requirements of subsections (i) and (k) are met and the Secretary determines that—

(A) the average per household energy use within the United States by products of such type (or class) exceeded 150 kilowatt-hours (or its Btu equivalent) for any 12-month period ending before such determinations;

(B) the aggregate household energy use within the United States by products of such type (or class) exceeded 4,200,000,000 kilowatt-hours (or its Btu equivalent) for any such 12-month period;

(C) substantial improvement in the energy efficiency of products of such type (or class) is technologically feasible; and

(D) the application of a labeling rule under section 324 to such type (or class) is not likely to be sufficient to induce manufacturers to produce, and consumers and other persons to purchase, covered products of such type (or class) which achieve the maximum energy efficiency which is technologically feasible and economically justified.

(2) Any new or amended standard for covered products of a type specified in paragraph (12) of section 322(a) shall not apply to products manufactured within five years after the publication of a final rule establishing such standard.

(3) The Secretary may, in accordance with subsections (j) and (k), prescribe an energy conservation standard for television sets. Any such standard may not become effective with respect to products manufactured before January 1, 1982.

(j) Criteria for Prescribing New or Amended Standards.—(1) The Secretary may not prescribe any amended standard which increases the maximum allowable energy use, or decreases the minimum required energy efficiency, of a covered product.

(2)(A) Any new or amended energy conservation standard prescribed by the Secretary under this section for any type (or class) of covered product shall be designed to achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified.

(B)(i) In determining whether a standard is economically justified, the Secretary shall, after receiving views and comments furnished with respect to the proposed standard, determine whether the benefits of the standard exceed its burdens by, to the greatest extent practicable, considering—

(I) the economic impact of the standard on the manufacturers and on the consumers of the products subject to such standard;

(II) the savings in operating costs throughout the estimated average life of the covered product in the type (or class) compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered products which are likely to result from the imposition of the standard;

(III) the total projected amount of energy savings likely to result directly from the imposition of the standard;

(IV) any lessening of the utility or the proformance of the covered products likely to result from the imposition of the standard;

(V) the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the imposition of the standard;

(VI) the need for national energy conservation; and

(VII) other factors the Secretary considers relevant.

(ii) For purposes of clause (i)(V), the Attorney General shall make a determination of the impact, if any, of any lessening of competition likely to result from such standard and shall transmit such determination, not later than 60 days after the publication of a proposed rule prescribing or amending an energy conservation standard, in writing to the Secretary, together with an analysis of the nature and extent of such impact. Any such determination and analysis shall be published by the Secretary in the Federal Register.

(iii) If the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy savings during the first year that the consumer will receive as a result of the standard, as calculated under the applicable test procedure, there shall be a rebuttable presumption that such standard level is economically justified. A determination by the Secretary that such criterion is not met shall not be taken into consideration in the Secretary's determination of whether a standard is economically justified.

(3) The Secretary may not prescribe an amended or new standard under this section for a type (or class) of covered product of—

(A) for products other than dishwashers, clothes washers, clothes dryers, and kitchen ranges and ovens, a test procedure has not been prescribed pursuant to section 323 with respect to that type (or class) of product; or

(B) the Secretary determines, by rule, that the establishment of such standard will not result in significant conservation of energy or that the establishment of such standard is not technologically feasible or economically justified.

For purposes of section 327, a determination under subparagraph (B) with respect to any type (or class) of covered products shall have the same effect as would a standard prescribed for such type (or class).

(4) The Secretary may not prescribe as amended or new standard under this section if the Secretary finds (and publishes such finding) that interested persons have established by a preponderance of the evidence that the standard is likely to result in the unavailability in the United States in any covered product type (or class) of per-

formance characteristics (including reliability), features, sizes, capacities and volume that are substantially the same as those generally available in the United States at the time for the Secretary's finding. The failure of some types (or classes) to meet this criterion shall not affect the Secretary's determination of whether to prescribe a standard for other types (or classes).

(k) Procedure for Prescribing New or Amended Standards.—Any new or amended energy conservation standard shall be prescribed in accordance with the following procedure:

(1) The Secretary—

(A) shall publish an advance notice of proposed rulemaking which specifies the type (or class) of covered products to which the rule may apply;

(B) shall invite interested persons to submit, within 60 days after the date of publication of such advance notice, written presentations of data, views, and arguments in response to such notice; and

(C) may identify proposed or amended standards that may be prescribed.

(2) A proposed rule which prescribes an amended or new energy conservation standard or prescribes not amended or no new standard for a type (or class) of covered products shall be published in the Federal Register. In prescribing any such proposed rule with respect to a standard, the Secretary shall determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for each type (or class) of covered products. If such standard is not designed to achieve such efficiency or use, the Secretary shall state in the proposed rule the reasons therefor.

(3) After the publication of such proposed rulemaking, the Secretary shall, in accordance with section 336, afford interested persons an opportunity, during a period of not less than 60 days, to present oral and written comments (including an oppotunity to question those who make such presentations, as provided in such section) or matters relating to such proposed rule, including—

(A) whether the standard to be prescribed is economically justified (taking into account those factors which the Secretary must consider under subsection (j)(2)) or will result in the effects described in subsection (j)(4);

(B) whether the standard will achieve the maximum improvement in energy efficiency which is technologically feasible;

(C) if the standard will not achieve such improvement, whether the reasons for not achieving such improvement are adequate; and

(D) whether such rule should prescribe a level of energy use or efficiency which is higher or lower than that which would otherwise apply in the case of any group of products within the type (or class) that will be subject to such standard.

(4) A final rule prescribing an amended or new energy conservation standard or prescribing no amended or new standard for a type (or class) of covered products shall be published as soon as is practicable, but not less than 90 days, after publication of the proposed rule in the Federal Register.

(l) Special Rule for Certain Types of Classes of Products.—(1) A rule prescribing an energy conservation standard for a type (or class) of covered products shall specify a level of energy use or efficiency higher or lower than which applies (or would apply) for such type (or class) for any group of covered products which have the same function or intended use, if the Secretary determines that covered products within such group—

(A) consume a different kind of energy from that consumed by other covered products within such type (or class); or

(B) have capacity or other performance-related feature which other products within such type (or class) do not have and such feature justifies a higher or lower standard from that which applies (or will apply) to other products within such type (or class).

In making a determination under this paragraph concerning whether a performance-related feature justifies the establishment of a higher or lower standard, the Secretary shall consider such factors as the utility to the consumer of such a feature, and such other factors as the Secretary deems appropriate.

(2) Any rule prescribing a higher or lower level of energy use or efficiency under paragraph (1) shall include an explanation of the basis on which such higher or lower level was established.

(m) Inclusion in Standards of Test Procedures and Other Requirements.—Any new or amended energy conservation standard prescribed under this section shall include where applicable, test procedures prescribed in accordance with section 323 and may include any requirement which the Secretary determines is necessary to assure that each covered product to which such standard applies meets the required minimum level of energy efficiency or maximum quantity of energy use specified in such standard.

(n) Determination of Compliance With Standards.—Compliance with, and performance under, the energy conservation standards (except for design standards authorized by this part) established in, or prescribed under this shall be determined using the test procedures and corresponding compliance criteria prescribed under section 323.

(o) Small Manufacturer Exemption.—(1) Subject to paragraph (2), the Secretary may, on application of any manufacturer, exempt such manufacturer from all or part of the requirements of any energy conservation standard established in or prescribed under this section for any period not longer than the 24-month period beginning on the date such rule becomes effective, if the Secretary finds that the annual gross revenues, of such manufacturer from all its operations (including the manufacture and sale of covered products) does not exceed $8,000,000 for the 12-month period preceding the date of the application. In making such finding with respect to any manufacturer, the Secretary shall take into account the annual gross revenues of any other person who controls, is controlled by or is under common control with, such manufacturer.

(2) The Secretary may not exercise the authority granted under paragraph (1) with respect to any type (or class) of covered product subject to an energy conservation standard under this section unless

the Secretary makes a finding, after obtaining the written views of the Attorney General, that a failure to allow an exemption under paragraph (1) would likely result in a lessening of competition.

REQUIREMENTS OF MANUFACTURERS

Sec. 326. [(a)] *(a) In General.*—Each manufacturer of a covered product to which a rule under section 324 applies shall provide a label which meets, and is displayed in accordance with, the requirements of such rule. If such manufacturer or any distributor, retailer, or private labeler of such product advertises such product in a catalog from which it may be purchased, such catalog shall contain all information required to be displayed on the label, except as otherwise provided by rule of the Commission. The preceding sentence shall not require that a catalog contain information respecting a covered product if the distribution of such catalog commenced before the effective date of the labeling rule under section 324 applicable to such product.

[(b)(1)] *(b) Notification.*—Each manufacturer of a covered product to which a rule under section 324 applies shall notify the Secretary or the Commission—

(A) not later than 60 days after the date such rule takes effect, of the models in current production (and starting serial numbers of those models) to which such rule applies; and

(B) prior to commencement of production, of all models subsequently produced (and starting serial numbers of those models) to which such rule applies.

* * * * * * *

(3) When requested—

(A) by the Secretary for purposes of ascertaining whether a product subject to a standard *established in or* prescribed under section 325 is in compliance with that standard, or

(B) by the Commission for purposes of ascertaining whether the information set out on a label of a product, as required under section 324, is accurate.

each manufacturer of such a product shall supply at his expense a reasonable number of such covered products to any laboratory designated by the Secretary or the Commission, as the case may be. Any reasonable charge levied by the laboratory for such testing shall be borne by the United States, if and to the extent provided in appropriation Acts.

* * * * * * *

[(c) Each] *(c) Deadline.—Each* manufacturer shall use labels reflecting the range data required to be disclosed under section 324(c)(1)(B) after the expiration of 60 days following the date of publication of any revised table of ranges unless the rule under section 324 provides for a later date. The Commission may not require labels be changed to reflect revised tables of ranges more often than annually.

[(d) For purposes of carrying out this part, the Secretary may require, under authority otherwise available to him under this part or other provisions by law administered by him, each manufacturer of covered products to submit such information or reports of any kind or nature directly to the Secretary with respect to energy efficiently of such covered products, and with respect to the economic impact of any proposed energy efficiency standard, as the Secretary determines may be necessary to establish and revise test procedures, labeling rules, and energy efficiency standards for such products and to insure compliance with the requirements of this part. The provisions of section 11(d) of the Energy Supply and Environmental Coordination Act of 1974 shall apply with respect to information obtained under this subsection to the same extent and in same manner as it applies with respect to energy information obtained under section 11 of such Act.]

(d) Information Requirements.—(1) For purposes of carrying out this part, the Secretary may require, under this part or other provision of law administered by the Secretary, each manufacturer of a covered product to submit information or reports to the Secretary with respect to energy efficiency or energy use of such covered product and the economic impact of any proposed energy conservation standard, as the Secretary determines may be necessary to establish and revise test procedures, labeling rules, and energy conservation standards for such product and to insure compliance with the requirements of this part. In making any determination under this paragraph, the Secretary shall consider existing public sources of information, including nationally recognized certification programs of trade associations.

(2) The Secretary shall exercise authority under this section in a manner designed to minimize unnecessary burdens on manufacturers of covered products.

(3) The provisions of section 11(d) of the Energy Supply and Environmental Coordination Act of 1974 shall apply with respect to information obtained under this subsection to the same extent and in the same manner as they apply with respect to energy information obtained under section 11 of such Act.

[EFFECTS ON OTHER LAW

[Sec. 327. (a) This part supersedes any State regulation insofar as such State regulation may now or hereafter provide for—

[(1) the disclosure of information with respect to any measure of energy consumption of any covered product—

[(A) if there is any rule under section 323 applicable to such covered product, and such State regulation requires testing in any manner other than that prescribed in such rule under section 323, or

[(B) if there is a rule under section 324 applicable to such covered product and such State regulation requires disclosure of information other than information disclosed in accordance with such rule under section 324; or

[(2) any energy efficiency standard or other requirement with respect to energy efficiency or energy use of a covered product—

[(A) if there is a standard under section 325 applicable to such product, and such State regulation is not identical to such standard, or

[(B) if there is a rule under section 323 or 324 applicable to such product and such State regulation requires testing in accordance with test procedures which are not identical to the test procedures specified in such rule.

[(b)(1) If a State regulation is prescribed which establishes an energy efficiency standard or other requirement respecting energy use or energy efficiency of a type (or class) of covered products and which is not superseded by subsection (a)(2) or (b)(2), then any person subject to such regulation may file a petition with the Secretary requesting that the Secretary prescribe a rule under this subsection which supersedes such State regulation in whole or in part. The Secretary, after consideration of the petition, the views of the affected State and the comments of any interested person, shall issue such requested rule only if the Secretary finds (and publishes such finding) that—

[(A) there is no significant State or local interest sufficient to justify such State regulation; and

[(B) such State regulation unduly burdens interstate commerce.

[(2) If a State regulation is prescribed after January 1, 1978, which establishes an energy efficiency standard or requirement respecting energy use or energy efficiency of a type (or class) of covered products and which is not superseded by subsection (a)(2), then such State regulation is superseded. Notwithstanding the requirement of the preceding sentence, such State may file a petition with the Secretary requesting a rule that such State regulation is not superseded pursuant to this paragraph. The Secretary, after consideration of the petition and the comments of interested persons, shall prescribe such rule only if he finds there is a significant State or local interest to justify such State regulations; except that the Secretary may not prescribe such rule if he finds that such State regulation would unduly burden interstate commerce.

[(3) Notwithstanding subsection (a)(2), any State prescribing a State regulation which provides an energy efficiency standard or other requirement respecting energy use or energy efficiency for any type (or class) of covered products for which a Federal energy efficiency standard is applicable may file a petition with the Secretary requesting a rule that such regulation not be superseded. The Secretary, after consideration of the petition and the comments of interested persons, shall prescribe such rule only if he finds (and publishes such finding) that—

[(A) there is a significant State or local interest to justify such State regulation; and

[(B) such State regulation contains a more stringent energy efficiency standard than such Federal standard;

except that the Secretary may not prescribe such rule if he finds that such State regulation would unduly burden interstate commerce.

[(4) The Secretary shall give notice of any petition filed under this subsection and afford interested persons a reasonable opportunity to make written comments thereon. The Secretary, within 6 months after the date any petition is filed, shall deny such petition or prescribe the requested rule, except that the Secretary may publish a notice in the Federal Register extending such period to a date certain. Such notice shall include the reasons for delay. In the case of any denial of a petition under this subsection, the Secretary shall publish in the Federal Register notice of such denial and the reasons for such denial.

[(5) The requirement of paragraph (2) shall not continue in effect after July 1, 1980, in the case of any type (or class) or covered products specified in paragraphs (1) through (13) of section 322(a).

[(c) Notwithstanding the provisions of subsection (a), any State regulation which sets forth procurement standards for a State (or political subdivision thereof) shall not be superseded by the provisions of this part if such State standards are more stringent than the corresponding Federal standards.

[(d) For purposes of this section, the term "State regulation" means a law or regulation of a State or political subdivision thereof.

[(e) Any disclosure with respect to energy use, energy efficiency, or estimated annual operating costs, which is required to be made under the provisions of this part, shall not create an express or implied warranty under State or Federal law that such energy efficiency will be achieved, or that such energy use or estimated annual operating cost will not be exceeded, under conditions of actual use.]

EFFECT ON OTHER LAW

SEC. 327. (a) PREEMPTION OF TESTING AND LABELING REQUIREMENTS.—(1) Effective on the date of enactment of the National Appliance Energy Conservation Act of 1986, this part supersedes any State regulation insofar as such State regulation provides at any time for the disclosure of information with respect to any measure of energy consumption of any covered product if—

(A) such State regulation requires testing or the use of any measure of energy consumption or energy descriptor in any manner other than that provided under section 323; or

(B) such State regulation requires disclosure of information with respect to the energy use or energy efficiency of any covered product other than information required under section 324.

(2) For purposes of this section, the term "State regulation" means a law, regulation, or other requirement of a State or its political subdivisions.

(b) GENERAL RULE OF PREEMPTION FOR ENERGY CONSERVATION STANDARD BEFORE FEDERAL STANDARD BECOMES EFFECTIVE FOR A PRODUCT.—Effective on the date of enactment of the National Appliance Energy Conservation Act of 1986 and ending on the effective date of an energy conservation standard established under section 325 for any covered product, no State regulation, or revision thereof, concerning the energy efficiency or energy use of the covered product shall be effective with respect to such covered product, unless the State regulation or revision—

(1) was prescribed or enacted before January 8, 1987, and is applicable to products before January 3, 1988;

(2) is a State procurement regulation described in subsection (e);

(3) is a regulation described in subsection (f)(1) or is prescribed or enacted in a building code for new construction described in subsection (f)(2);

(4) is a regulation prohibiting the use in pool heaters of a constant burning pilot;

(5) is a regulation described in subsection (d)(5)(B) for which a waiver has been granted under subsection (d); or

(6) is a regulation effective on or after January 1, 1992, concerning the energy efficiency or energy use of television sets.

(c) GENERAL RULE OF PREEMPTION FOR ENERGY CONSERVATION STANDARDS WHEN FEDERAL STANDARD BECOMES EFFECTIVE FOR A PRODUCT.—Except as provided in section 325(b)(3)(A)(ii) and effective on the effective date of an energy conservation standard established in or prescribed under section 325 for any covered product, no State regulation concerning the energy efficiency or energy use of such covered product shall be effective with respect to such product unless the regulation—

(1) is a regulation described in paragraph (2) or (4) of subsection (b);

(2) is a regulation which has been granted a waiver under subsection (d); or

(3) is in a building code for new construction described in subsection (f)(3).

(d) WAIVER OF FEDERAL PREEMPTIONS.—(1)(A) Any State with a State regulation which provides for any energy conservation standard or other requirement with respect to energy use or energy efficiency for any type (or class) of covered product for which there is a Federal energy conservation standard under section 325 may file a petition with the Secretary requesting a rule that such State regulation become effective with respect to such covered product.

(B) Subject to paragraph (2) through (5), the Secretary shall, within the period described in paragraph (2) and after consideration of the petition and the comments of interested persons, prescribe such rule if the Secretary finds (and publishes such finding) that the State has established by a preponderance of the evidence that such State regulation is needed to meet unusual and compelling State or local energy interests.

(C) For purposes of this subsection, the term "unusual and compelling State or local energy interests" means interests which—

(i) are substantially different in nature or magnitude than those prevailing in the United States generally; and

(ii) are such that the costs, benefits, burdens, and reliability of energy savings resulting from the State regulation make such regulation preferable or necessary when measured against the costs, benefits, burdens, and reliability of alternative approaches to energy savings or production, including reliance on reasonably predictable market-induced improvements in efficiency of all products subject to the State regulation.

The factors described in clause (ii) shall be evaluated within the context of the State's energy plan and forecast.

(2) The Secretary shall give notice of any petition filed under paragraph (1)(A) and afford interested persons a reasonable opportunity to make written comments including rebuttal comments, thereon. The Secretary shall within the 6-month period beginning on the

date on which any such petition is filed, deny such petition or prescribe the requested rule, except that the Secretary may publish a notice in the Federal Register extending such period to a date certain but no longer than one year after the date on which the petition was filed. Such notice shall include the reasons for delay. In the case of any denial of a petition under this subsection, the Secretary shall publish in the Federal Register notice, of, and the reasons for such denial.

(3) The Secretary may not prescribe a rule under the subsection if the Secretary finds (and publishes such finding) that interested persons have established, by a preponderance of the evidence, that such State regulation will significantly burden manufacturing, marketing, distribution, sale, or servicing of the covered product on a national basis. In determining whether to make such finding, the Secretary shall evaluate all relevant factors, including—

(A) the extent to which the State regulation will increase manufacturing or distribution costs of manufacturers, distributors, and others;

(B) the extent to which the State regulation will disadvantage smaller manufacturers, distributors, or dealers or lessen competition in the sale of the covered product in the State;

(C) the extent to which the State regulation would cause a burden to manufacturers to redesign and produce the covered product type (or class), taking into consideration the extent to which the regulation would result in a reduction—

(i) in the current models, or in the projected availability of models, that could be shipped on the effective date of the regulation to the State and within the United States; or

(ii) in the current or projected sales volume of the covered product type (or class) in the State and the United States; and

(D) the extent to which the State regulation is likely to contribute significantly to a proliferation of State appliance efficiency requirements and the cumulative impact such requirements would have.

(4) The Secretary may not prescribe a rule under this subsection if the Secretary finds (and publishes such finding) that interested persons have established, by a preponderance of the evidence, that the State regulation is likely to result in the unavailability in the State of any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the State at the time of the Secretary's finding, except that the failure of some classes (or types) to meet this criterion shall not affect the Secretary's determination of whether to prescribe a rule for other classes (or types).

(5) No final rule prescribed by the Secretary under this subsection may—

(A) permit any State regulation to become effective with respect to any covered product manufactured within three years after such rule is published in the Federal Register or within five years if the Secretary finds that such additional time is necessary due to the substantial burdens of retooling, redesign, or distribution needed to comply with the State regulation; or

(B) become effective with respect to a covered product manufactured before the earliest possible effective date specified in section 325 for the initial amendment of the energy conservation standard establised in such section for the covered product; except that such rule may become effective before such date if the Secretary finds (and publishes such finding) that, in addition to the other requirements of this subsection the State has established, by a preponderance of the evidence, that—

(i) an energy emergency condition exists within the State which—

(I) imperils the health, safety, and welfare of its residents because of the inability of the State or utilities within the State to provide adequate quantities of gas or electric energy to its residents at less than prohibitive costs; and

(II) cannot be substantially alleviated by the importation of energy or the use of interconnection agreement; and

(ii) the State regulation is necessary to alleviate substantially such condition.

(6) In any case in which a State is issued a rule under paragraph (1) with respect to a covered produce and subsequently a Federal energy conservation standard concerning such product is amended pursuant to section 325, any person subject to such State regulation may file a petition with the Secretary requesting the Secretary to withdraw the arule issued under paragraph (1) with respect to such product in such State. The Secretary shall consider such petition in accordance with the requirements of paragraphs (1), (3), and (4), except that the burden shall be on the petitioner to show by a preponderance of evidence that the rule received by the State under paragraph (1) should be withdrawn as a result of the amendment to the Federal standard. If the Secretary determines that the petitioner has shown that the rule issued by the State should be so withdrawn, the Secretary shall withdrew it.

(e) Exception for Certain State Procurement Standards.—Any State regulation which sets forth procurement standards for a State (or political subdivision thereof) shall not be superseded by the provisions of this part if such standards are more stringent than the corresponding Federal energy conservation standards.

(f) Exception for Certain Building Code Requirements.—(1) A regulation or other requirement enacted or prescribed before January 8, 1987, that is contained in a State or local building code for new construction concerning the energy efficiency or energy use of a covered product is not superseded by this part until the effective date of the energy conservation standard established in or prescribed under section 325 for such covered product.

(2) A regulation or other requirement, or revision thereof, enacted or prescribed on or after January 8, 1987, that is contained in a State or local building code for new construction concerning the energy efficiency or energy use of a covered product is not superseded by this part until the effective date of the energy conservation standard established in or prescribed under section 325 for such covered product if the code does not require that the energy efficiency of such covered product exceed—

(A) the applicable minimum efficiency requirement in a national voluntary consensus standard; or

(B) the minimum energy efficiency level in a regulation or other requirement of the State meeting the requirements of subsection (b)(1) or (b)(5),

whichever is higher.

(3) Effective on the effective date of an energy conservation standard for a covered product established in or prescribed under section 325, a regulation or other requirement contained in a State or local building code for new construction concerning the energy efficiency or energy use of such covered product is not superseded by this part if the code complies with all of the following requirements:

(A) The code permits a builder to meet an energy consumption or conservation objective for a building by selecting items whose combined energy efficiencies meet the objective.

(B) The code does not require that the covered product have an energy efficiency exceeding the applicable energy conservation standard established in or prescribed under section 325, except that the required efficiency may exceed such standard up to the level required by a regulation of that State for which the Secretary has issued a rule granting a waiver under subsection (d).

(C) The credit to the energy consumption or conservation objective allowed by the code of installing covered products having energy efficiencies exceeding such energy conservation standard established in or prescribed under section 325 or the efficiency level required in a State regulation referred to in subparagraph (B) is on a one-for-one equivalent energy use or equivalent cost basis.

(D) If the code uses one or more baseline building designs against which all submitted building designs are to be evaluated and such baseline building designs contain a covered product subject to an energy conservation standard established in or prescribed under section 325, the baseline building designs are based on the efficiency level for such covered product which meets but does not exceed such standard or the efficiency level required by a regulation of that State for which the Secretary has issued a rule granting a waiver under subsection (d).

(E) If the code sets forth one or more optional combinations of items which meet the energy consumption or conservation objective, for every combination which includes a covered product the efficiency of which exceeds either standard or level referred to in subparagraph (D), there also shall be at least one combination which includes such covered product the efficiency of which does not exceed such standard or level by more than 5 percent, except that at least one combination shall include such covered product the efficiency of which meets but does not exceed such standard.

(F) The code does not arbitrarily attempt to promote or discourage use of any type of covered product.

(G) The energy consumption or conservation objective is specified in terms of an estimated total consumption of energy (which may be calculated from energy loss- or gain-based codes)

utilizing an equivalent amount of energy (which may be specified in units of energy or its equivalent cost).

(H) The estimated energy use of any covered product permitted or required in the code, or used in calculating the objective, is determined using the applicable test procedures prescribed under section 323, except that the estimated energy use calculation may be adjusted to reflect the conditions of the areas where the code is being applied if such adjustment is based on the use of the applicable test procedures prescribed under section 323 or other technically accurate documented procedure.

(4)(A) Subject to subparagraph (B), a State or local government is not required to submit a petition to the Secretary in order to enforce or apply its building code or to establish that the code meets the conditions set forth in this subsection.

(B) If a building code requires the installation of covered products with efficiencies exceeding both the applicable Federal standard established in or prescribed under section 325 and the applicable standard of such State, if any, that has been granted a waiver under subsection (d), such requirement of the building code shall not be applicable unless the Secretary has granted a waiver for such requirement under subsection (d).

(g) No Warranty.—Any disclosure with respect to energy use, energy efficiency, or estimated annual operating cost which is required to be made under the provisions of this part shall not create an express or implied warranty under State or Federal law that such energy efficiency will be achieved or that such energy use or estimated annual operating cost will not be exceeded under conditions of actual use.

AUTHORITY TO OBTAIN INFORMATION

Sec. 329. (a) *In General.*—For purposes of carrying out this part the Commission and the Secretary may each sign and issue subpenas for the attendance and testimony of witnesses and the production of relevent books, records, papers, and other documents, and may each administer oaths. Witnesses summoned under the provisions of this section shall be paid the same fees and mileage as are paid to witnesses in the courts of the United States. In case of contumacy by, or refusal to obey a subpena served, upon any persons subject to this part, the Commission and the Secretary may each seek an order from the direct court of the United States for any district in which such person is found or resides or transacts business requiring such person to appear and give testimony, or to appear and produce documents. Failure to obey such order is punishable by such court as a contempt thereof.

(b) *Confidentiality.*—Any information submitted by any person to the Secretary or the Commission under this part shall not be considered energy information as defined by section 11(e)(1) of the Energy Supply and Environmental Coordination Act of 1974 for purposes of any verification examination authorized to be conducted by the Comptroller General under section 501 of this Act.

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PROHIBITED ACTS

Sec. 332. *In General.*—It shall be unlawful—

(1) * * *

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(5) for any manufacturer or private labeler to distribute in commerce any new covered product which is not in conformity with an applicable [energy efficiency standard prescribed under] *energy conservation standard established in or prescribed under* this part.

(b) *Definition.*—For purposes of this section, the term "new covered product" means a covered product the title of which has not passed to a purchaser who buys such product for purposes other than (1) reselling such product, or (2) leasing such product for a period in excess of one year.

ENFORCEMENT

Sec. 333. (a) *In General.*—Except as provided in subsection (c), any person who knowingly violates any provision of section 332 shall be subject to a civil penalty of not more than $100 for each violation. Such penalties shall be assessed by the Commission, except that penalties for violations of section 332(a)(3) which relate to requirements prescribed by the Secretary, violations of section 332(a)(4) which relate to requests of the Secretary under section 326(b)(2), or violations of section 332(a)(5) shall be assessed by the Secretary. Civil penalties assessed under this part may be compromised by the agency or officer authorized to assess the penalty, taking into account the nature and degree of the violation and the impact of the penalty upon a particular respondent. Each violation of paragraph (1), (2), or (5) of section 332(a) shall constitute a separate violation with respect to each covered product, and each day of violation of section 332(a) (3) or (4) shall constitute a separate violation.

(b) *Definition.*—As used in subsection (a), the term "knowingly" means (1) the having of actual knowledge, or (2) the presumed having of knowledge deemed to be possessed by a reasonable man who acts in the circumstances, including knowledge obtainable upon the exercise of due care.

[(c) It] *(c) Special Rule.—It* shall be an unfair or deceptive act or practice in or affecting commerce (within the meaning of section 5(a)(1) of the Federal Trade Commission Act) for any person to violate section 323(c), except to the exten that such violation is prohibited under the provisions of section 332(a)(1), in which case such provisions shall apply.

[(d)(1)] *(d) Procedure for Assessing Penalty.—(1)* Before issuing an order assessing a civil penalty against any person under this section, the Secretary shall provide to such person notice of the proposed penalty. Such notice shall inform such person of his opportunity to elect in writing within 30 days after the date of receipt of such notice to have the procedures of paragraph (3) (in lieu of those of paragraph (2)) apply with respect to such assessment.

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CITIZEN SUITS

SEC. 335. (a) Except as otherwise provided in subsection (b), any person may commence a civil action against—

(1) any manufacturer or private labeler who is alleged to be in violation of any provision of this part or any rule under this part; [or]

(2) any Federal agency which has a responsibility under this part where there is an alleged failure of such agency to perform any act or duty under this part which is not discretionary[.]*; or*

(3) the Secretary in any case in which there is an alleged failure of the Secretary to comply with a nondiscretionary duty to issue a proposed or final rule according to the schedules set forth in section 325.

The United States district courts shall have jurisdiction, without regard to the amount in controversy or the citizenship of the parties, to enforce such provision or rule, or order such Federal agency to perform such act or duty, as the case may be. *The courts shall advance on the docket, and expedite the disposition of, all causes filed therein pursuant to paragraph (3) of this subsection. If the court finds that the Secretary has failed to comply with a deadline established in section 325, the court shall have jurisdiction to order appropriate relief, including relief that will ensure the Secretary's compliance with future deadlines for the same covered product.*

(b) *LIMITATION.*—No action may be commenced—

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(c) *RIGHT TO INTERVENE.*—In such action under this section, the Secretary or the Commission (or both), if not a party, may intervene as a matter of right.

(d) *AWARD OF COSTS OF LITIGATION.*—The court, in issuing any final order in any action brought pursuant to subsection (a) of this section, may award costs of litigation (including reasonable attorney and expert witness fees) to any party, whenever the court determines such award is appropriate.

(e) *PRESERVATION OF OTHER RELIEF.*—Nothing in this section shall restrict any right which any person (or class of persons) may have under any statute or common law to seek enforcement of this part or any rule thereunder, or to seek any other relief (including relief against the Secretary or the Commission).

(f) *COMPLIANCE IN GOOD FAITH.*—For purposes of this section, if a manufacturer or private labeler complied in good faith with a rule under this part, then he shall not be deemed to have violated any provision of this part by reason of the alleged invalidity of such rule.

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[ADMINISTRATIVE PROCEDURE AND JUDICIAL REVIEW

[SEC. 336. (a) Rules under sections 323, 324, 325(a), 327(b), or 328 shall be prescribed in accordance with section 553 of title 5, United States Code, except that—

[(1) interested persons shall be afforded an opportunity to present written and oral data, views, and arguments with respect to any proposed rule, and

[(2) in the case of a rule under section 325(a), the Secretary shall, by means of conferences or other informal procedures, afford any interested person an opportunity to question—

[(A) other interested persons who have made oral presentations under paragraph (1), and

[(B) employees of the United States who have made written or oral presentations,

with respect to disputed issues of material fact. Such opportunity shall be afforded to the extent the Secretary determines that questioning pursuant to such procedures is likely to result in a more timely and effective resolution of such issues.

A transcript shall be kept of any oral presentations made under this subsection.

[(2) Subsection (c) and (d) of section 18 of the Federal Trade Commission Act shall apply to rules under section 325 (other than subsections (a)(1), (2), and (3)) to the same extent that such subsections apply to rules under section 18(a)(1)(B) of such Act.

[(b)(1) Any person who will be adversely affected by a rule prescribed under section 323, 324, or 325 when it is effective may, at any time prior to the sixtieth day after the date of such rule is prescribed, file a petition with the United States court of appeals for the circuit wherein such person resides or has his principal place of business, for a judicial review thereof. A copy of the petition shall be forthwith transmitted by the clerk of the court of the agency which prescribed the rule. Such agency thereupon shall file in the court the written submission to, and transcript of, the proceedings on which the rule was based as provided in section 2112 of title 28, United States Code.

[(2) Upon the filing of the petition referred to in paragraph (1), the court shall have jurisdiction to review the rule in accordance with chapter 7 of title 5, United States Code, and grant appropriate relief as provided in such chapter. No rule under section 323, 324, or 325 may be affirmed unless supported by substantial evidence.

[(3) The judgment of the court affirming or setting aside, in whole or in part, any such rule shall be final, subject to review by the Supreme Court of the United States upon certiorari or certification as provided in section 1254 of title 28, United States Code.

[(4) The remedies provided for in this subsection shall be in addition to, and not in substitution for, any other remedies provided by law.

[(c)(1) Title IV and V of the Department of Energy Organization Act (42 U.S.C. 7191 et seq.) shall not apply with respect to the procedures under this part.

[(2) The procedures applicable under this part shall not—

[(A) be considered to be modified or affected by any other provision of law unless such other provision specifically amends this part (or provisions of law cited herein), or

[(B) be considered to be superseded by any other provision of law unless such other provision does so in specific terms, referring to this part and declaring that such provisions supersedes in whole or in part, the procedures of this part.]

ADMINISTRATIVE PROCEDURE AND JUDICIAL REVIEW

Sec. 336. (a)(1) In addition to the requirements of section 553 of title 5, United States Code, rules prescribed under section 323, 324, 325, 327, or 328 of this part shall afford interested persons an opportunity to present written and oral data, views, and agruments with respect to any proposed rule.

(2) In the case of a rule prescribed under section 325, the Secretary shall, by means of conferences or other informal procedures, afford any interested person an opportunity to question—

(A) other interested persons who have made oral presentations; and

(B) employees of the United States who have made written or oral presentations with respect to disputed issues of material fact.

Such opportunity shall be afforded to the extent the Secretary determines that questioning pursuant to such procedures is likely to result in a more timely and effective resolution of such issues.

(3) A transcript shall be kept of any oral presentations made under this subsection.

(b)(1) Any person who will be adversely affected by a rule prescribed under section 323, 324, or 325 may, at any time within 60 days after the date on which such rule is prescribed, file a petition with the United States court of appeals for the circuit in which such person resides or has his principal place of business, for judicial review of such rule. A copy of the petition shall be transmitted by the clerk of the court to the agency which prescribed the rule. Such agency shall file in the court the written submissions to, and transcript of, the proceedings on which the rule was based, as provided in section 2112 of title 28, United States Code.

(2) Upon the filing of the petiton referred to in paragraph (1), the court shall have jurisdiction to review the rule is accordance with chapter 7 of title 5, United States Code, and to grant appropriate relief as provided in such chapter. No rule under section 323, 324, or 325 may be affirmed unless supported by substantial evidence.

(3) The judgment of the court affirming or setting aside, in whole or in part, any such rule shall be final, subject to review by the Supreme Court of the United States upon certiorari or certification as provided in section 1254 of title 28, United States Code.

(4) The remedies provided for in this subsection shall be in addition to, and not in substitution for, any other remedies provided by law.

(5) The procedures applicable under this part shall not—

(A) be considered to be modified or affected by any other provision of law unless such other provision specifically amends this part (or provisions of law cited herein); or

(B) be considered to be suspended by any other provision of law unless such other provision does so in specific terms by referring to this part and declaring that such provision supersedes, in whole or in part, the procedures of this part.

(c) Jurisdiction is vested in the Federal district court of the United States over actions brought by any adversely affected person

to determine whether a State of local government is complying with the requirements of this part.

* * * * * * *

ANNUAL REPORT

Sec. 338. The Secretary shall report to the Congress and the President either (1) as part of his annual report, or (2) in a separate report submitted annually, on the progress of the program undertaken pursuant to this part and on the energy savings impact of this part. Each such report shall specify the actions undertaken by the Secretary in carrying out this part during the period covered by such report, and those actions which the Secretary was required to take under this part, during such period but which were not taken together with the reasons therefor. *Nothing in this section provides a defense or justification for a failure by the Secretary to comply with a nondiscretionary duty as provided for in this part.*

AUTHORIZATION OF APPROPRIATIONS

Sec. 339. (a) *Authorizations for the Secretary.*—There are authorized to be appropriated to the Secretary not more than the following amounts to carry out his responsibilities under the part—

* * * * * * *

(b) *Authorizations for the Commission.*—There are authorized to be appropriated to the Commission not more than the following to carry out its responsibilities under this part—

* * * * * * *

(c) *Other Authorizations.*—There are authorized to be appropriated to the Secretary to be allocated not more than the following amounts—

* * * * * * *

○

APPENDIX F-4

Coalition for Federal Appliance Efficiency Standards

March 5, 1987

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H.R. 87

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Coalition for Federal Appliance Efficiency Standards

February 5, 1987

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